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*Final*

# Quality Assurance Program for Performing a Remedial Investigation

*for the*

## National Aeronautics and Space Administration Jet Propulsion Laboratory

4800 Oak Grove Drive
Pasadena, California 91109



EBASCO ENVIRONMENTAL

DECEMBER 1993

**FINAL**

# QUALITY ASSURANCE PROJECT PLAN

# FOR PERFORMING A

# REMEDIAL INVESTIGATION

# AT THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JET PROPULSION LABORATORY
4800 OAK GROVE DRIVE
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## LIST OF ACRONYMS

| | |
|---|---|
| BNAs | Base-Neutral-Acid Compounds |
| CDHS | California Department of Health Services |
| CLP | Contract Laboratory Program |
| CRZ | Contamination Reduction Zone |
| DQO | Data Quality Objectives |
| EPA | Environmental Protection Agency |
| FSAP | Field Sampling and Analysis Plan |
| GC | Gas Chromatograph |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| GLP | Good Laboratory Practice |
| ICP | Inductively Coupled Plasma Spectrometry |
| JPL | Jet Propulsion Laboratory |
| MDL | Method Detection Limits |
| MS | Matrix Spikes |
| MSD | Matrix Spiked Duplicates |
| NDPM | NASA Designated Project Manager |
| NDQAO | NASA Designated Quality Assurance Officer |
| OU | Operable Unit |
| OUM | NASA Authorized Subcontractor Operable Unit Manager |
| OVA | Organic Vapor Analyzer |
| PARCC | Precision, Accuracy, Reproducibility, Completeness, and Comparability |
| QA | Quality Assurance |
| QA/QC | Quality Assurance/Quality Control |
| QAP | Quality Assurance Plan |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RPD | Relative Percentage Differences |
| RT | Retention Time |
| SOP | Standard Operating Procedure |
| TPH | Total Petroleum Hydrocarbons |
| USCS | Unified Soil Classification System |
| VOC | Volatile Organic Compound |

# 1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared to ensure proper performance of the NASA Jet Propulsion Laboratory (JPL) Remedial Investigation/Feasibility Study (RI/FS) program. The term "JPL" is used throughout this document to refer to the facilities located at 4800 Oak Grove Drive in Pasadena, California.

This document describes the QA plan, which complies with the Environmental Protection Agency, Office of Research and Development, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 1980; RCRA Groundwater Monitoring Technical Enforcement Guidance Document, September 1986; Data Quality Objectives for Remedial Response Activities, EPA 540/5-87/003A; Laboratory Data Validation, Functional Guidelines for Evaluating Organic and Inorganic Analyses, February 1988, and State of California requirements for sampling, and analyses of environmental samples from various media.

The QAPP is not a substitute for the Operable Unit (OU) specific Field Sampling Analysis Plan (FSAP) and/or Quality Assurance Plan (QAP) for laboratory operations. All laboratories involved in sample analyses will be required to maintain an in-house QAP to meet the JPL project goals. Therefore, field and laboratory Quality Assurance/Quality Control (QA/QC) procedures are only discussed briefly, with specific emphasis on those areas that may affect the entire project.

This document contains discussions on the following topics:

- Project Description
- Project Organization and Responsibilities
- QA Objectives for Measurement of Data
- Sampling Procedures

- Sample Custody
- Calibration Procedures
- Data Reduction, Validation and Reporting
- Internal Quality Control
- Performance and Systems Audits
- Preventative Maintenance
- Data Assessment Procedures
- Corrective Action
- Quality Assurance Reports
- Nonconformance and Corrective Action Procedures

## 2.0 PROJECT DESCRIPTION AND OBJECTIVE

The objective of this project is to conduct RI/FS Studies of source locations and groundwater contaminants at the JPL. Based on current information, the RI/FS for the site will focus on the drilling and installation of groundwater wells to evaluate the nature and extent of contaminants of interest in groundwater and soil and on the collection of soil vapor and direct soil samples to evaluate the location of potential contaminant sources. Specific information on the planned field, laboratory, and office-based studies may be found in the RI/FS Work Plan and the OU-specific FSAPs.

This QAPP is designed to support the installation of groundwater monitoring wells and the investigation of the source of groundwater contamination in compliance with California and federal regulations. To accomplish this, sampling and analyses are conducted to quantify the nature and extent of groundwater contaminants and contaminant source locations. The technical data generated by this effort will be used to develop strategies to plan and implement the remedial necessary alternatives.

The specific objectives for the QA Program are the following:

- Ensure precision and accuracy for measurement data;
- Ensure validity of procedures and systems used to achieve project goals;
- Ensure that documentation is verified and complete;
- Quickly determine deficiencies affecting quality of data;
- Ensure that technically defensible and consistent field procedures are used in sample collections;
- Document procedures used in the collection, preservation, and handling of samples;
- Control the collection of samples of each matrix such that data accuracy, precision, and representativeness may be assessed; and
- Provide documented and approved procedures for the chemical analyses of all samples, including those collected for quality control, that will ensure data validity.

# 3.0 PROJECT SCHEDULE, ORGANIZATION, AND RESPONSIBILITIES

The organization of project personnel and schedule is an integral part of the QA Project Plan. Under the direction of the NASA Designated Project Manager and to maintain consistency, selected personnel have been designated to carry out key functions when project tasks are performed. The titles and responsibilities of the project team members are provided in this section. A summary of the project organization is shown in Figure 3-1.

## 3.1 PROJECT SCHEDULE

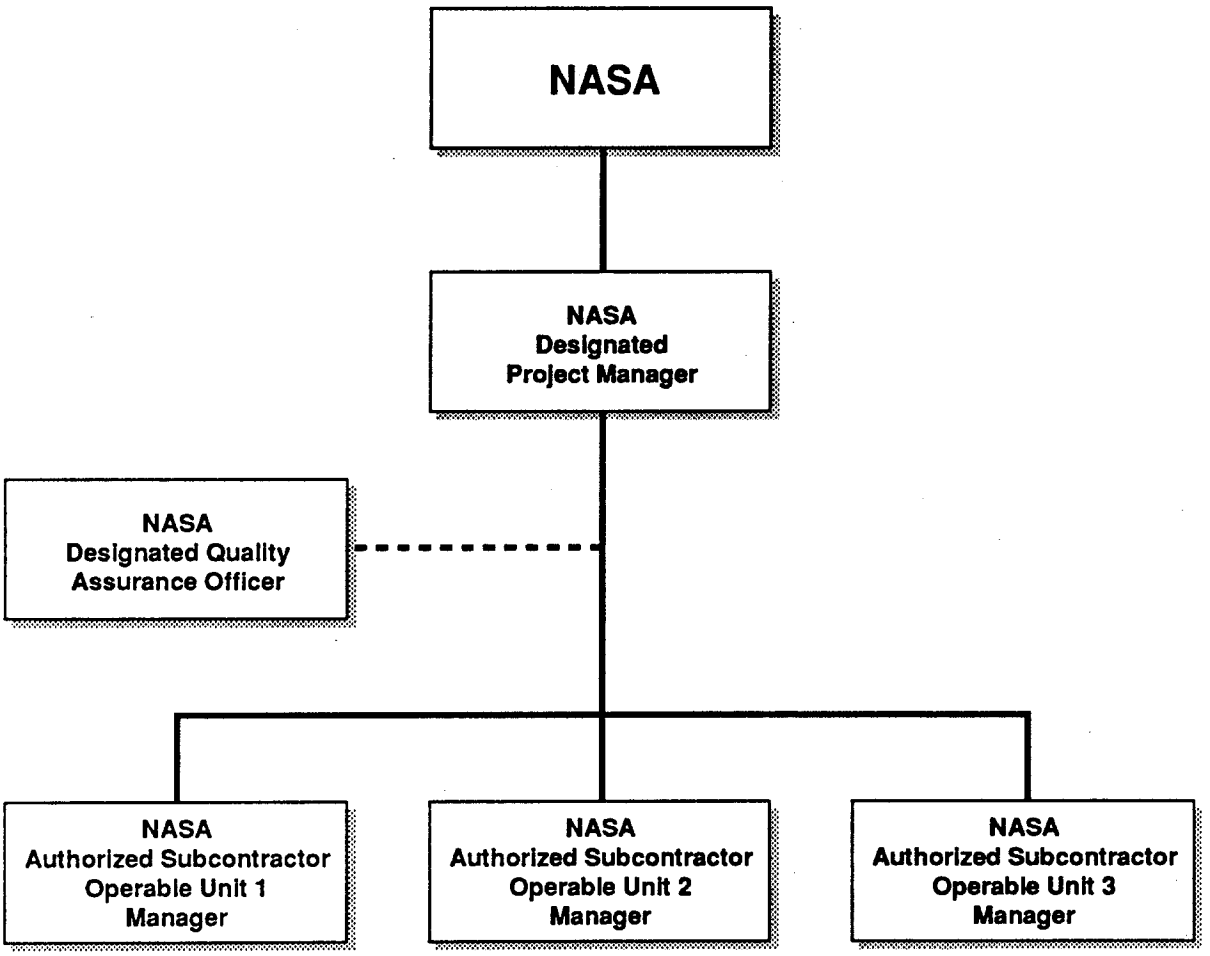
For this project, a schedule is developed to provide an estimate of time for completion of various tasks and subtasks. The project schedule delineates all milestones and subsequent activities that may depend on it. A proposed project schedule for this project is included in Appendix F of this QAPP.

## 3.2 NASA DESIGNATED PROJECT MANAGER (NDPM)

NASA has designated a contractor employee to act as the NASA Designated Project Manager (NDPM) until it designates an employee as Project Manager. When NASA designates a NASA employee as Project Manager, the efforts of other contractors and subcontractors noted below will be coordinated by a prime contractor's on-site supervisor who will work directly with the NASA Project Manager. NASA retains all final approvals and authority for tasks implementing the FFA unless it states otherwise. As the NASA Designated Project Manager, the contractor shall make recommendations, including recommendations regarding scope of work, budget, and schedule to NASA officials and obtain NASA's concurrence before proceeding.

FIGURE 3-1

SUMMARY OF PROJECT ORGANIZATION



## 3.3 THE NASA DESIGNATED QUALITY ASSURANCE OFFICER (NDQAO)

The NASA Designated Quality Assurance Officer (NDQAO) monitors the implementation of the QA plan; reviews laboratory performance; ensures verification and validation of data is completed by designated personnel; and enforces laboratory chain-of-custody and documentation procedures. The NDQAO shall assist in the following:

- Resolving all laboratory quality control problems in an expeditious manner and bringing them to the immediate attention of the NASA Designated Project Manager;
- Review all chemical analytical data for compliance with quality control requirements and technical accuracy;
- Ensure that performance and system audits are performed;
- Prepare and submit status reports of sampling problems and corrective actions to the NASA Designated Project Manager;
- Assist in the implementation of corrective action(s) to prevent re-occurrence of any problem;
- Ensure that the necessary corrective actions are taken by the NASA Designated Project Manager for all incidents of nonconformance;
- Schedule and verify an appropriate quality assurance activity for each field activity to ensure compliance with requirements and procedures;
- Ensure that field and laboratory logs, field variance forms and other deviations from approved plans are maintained for review upon request by the regulatory agencies;
- Coordinate with the laboratory on QA/QC matters;
- Track the progress of environmental samples throughout the process of acquisition, transportation, receipt, analysis, data validation, and data reporting; and
- Review laboratory QA/QC reports, and identify potential or existing problems.

The NDQAO shall conduct the following:

- Recommend specific or general work stoppages to the NASA Designated Project Manager for QC violations;
- Arrange for the performance of audits of laboratories to determine implementation of quality control procedures; and

- Recommend approval or disapproval of all laboratory and field data based on compliance with project quality control requirements.

## 3.4 NASA AUTHORIZED SUBCONTRACTOR OPERABLE UNIT MANAGER (OUM)

The JPL RI/FS program has been developed on the premise that there are three distinct operable units for evaluation. A separate NASA Authorized Subcontractor Operable Unit Manager (OUM) will be assigned to each unit. The OUM will assist in the development and implementation, with prior approval of the NDPM, all plans and studies required for their respective operable units. Each OUM will work closely with other project personnel on a frequent basis to implement the RI/FS Work Plan. In addition, each OUM will assist in the development of the FSAP for their respective OU and the technical specifications for needed subcontracts such as drilling, analytical laboratory services, surveying, and multi-port well equipment installation. These OUMs will procure and schedule all needed services.

# 4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA

The QA/QC specifications and requirements, as described in this section of the QAPP, are designed to generate quality data. Described in this section is the approach for conducting and controlling field sampling and chemical analyses for this project. Analytical data generated will be evaluated as to the degree to which they meet the prescribed procedures and criteria. All discussions presented in the section have been developed based on the requirements set forth in the "EPA Data Quality Objectives for Remedial Response Activities", EPA-540/G-87/003A, Laboratory Data Validation, Functional Guidelines for Evaluating Organic and Inorganic Analyses, February, 1988, and State of California Quality Assurance/Quality Control Guidance Document for Well Investigation Program.

## 4.1 DATA QUALITY

The analytical program set forth for the project will be used to quantify contaminant levels that will serve as a basis for a quantitative Risk Assessment and the completion of a Record of Decision for the selected Remedial Alternative(s). All information generated during these studies will be used to support project decisions for future action. Because of the QA/QC protocol and documentation employed for this investigation, the analytical data generated will be considered in accordance with State of California and Environmental Protection Agency requirements.

This proposed sampling and analysis program focuses on the requirements of developing the remedial alternatives and the criteria for evaluating the need for corrective actions. Emphasis is placed on the precision, accuracy, reproducibility, completeness, and comparability (PARCC) parameters necessary to satisfy these needs. Descriptions of and procedures required to assess the PARCC parameters of the measurement data are discussed in the following sections.

### 4.1.1 Precision

Precision measurement for field and laboratory parameters that test the reproducibility of data obtained for the project will be applied during field sampling and laboratory sample analyses.

Standardized precision evaluation methods are designed to measure variability associated with each field and analytical method for each analyte. Matrix induced precision analyses will be assessed by introducing matrix spikes (MS) and matrix spiked duplicates (MSD) in each sample lot (batch). The results (recoveries) obtained from these samples will be evaluated by calculating relative percentage differences (RPD). The formula to be used is defined as follows:

$$RPD = \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \times 100$$

where: $x_1$ and $x_2$ are initial and duplicate results, respectively.

Evaluation criteria for the RPD will be in accordance with EPA National Guidelines and EPA Region IX documents for data validation.

**Field Duplicate Samples:** To determine variance in sample results that may be due to sampling, duplicate samples (two samples) will be introduced. This will involve collection of samples from the same sampling location at the same time. Precision will be evaluated based on calculation of RPD.

$$RPD = \frac{(D_1 - D_2)}{(D_1 + D_2)/2} \times 100$$

where: $D_1$ and $D_2$ are initial and duplicate results, respectively.

### 4.1.2 Accuracy

Accuracy measures the bias in a measurement system. The determination of accuracy for the project will be based on the use of sample spikes. Using this method, the analytical laboratory adds a predetermined amount of a compound or element to a sample representative of site conditions and performs the analysis on the spiked and unspiked samples to test method accuracy.

GC/MS analytical methods (volatile and semi-volatile organics) require the spiking of actual samples with known concentration of surrogate compounds. The recovery information from these samples will be used to evaluate accuracy for individual samples and associated matrix interference. The calculation for percent recovery (USEPA Contract Laboratory Program, Statement of Work for Organic Analyses, Document Number 0LM01.2, January 1991) will be performed as follows:

$$\%R = \frac{Concentration\ Spike\ Found\ (blank\ spikes)}{Concentration\ Spiked} \times 100$$

$$\%R = Percent\ Recovery$$

Similarly, the ICP, AA, GC, and other parameters will use this approach on individual or designate samples to obtain accuracy for the analytical method and techniques. For inorganic analysis,

$$\%R = \frac{Spike\ Concen. - Environ.\ Sample\ Concen.\ (for\ spiked\ environmental\ samples)}{Amount\ Spiked} \times \frac{100}{1}$$

The criteria set forth in the EPA National Functional Guideline for Data Validation (organic and inorganic) and State of California Guidance for Data Validation will be used for this evaluation.

### 4.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent an environmental condition. The representativeness criterion is met by making certain that

sampling locations are selected properly and sufficient number of samples are collected. The criterion is met by ensuring that analytical methods selected will provide the appropriate detection limit for the parameters of interest, sufficient to meet regulatory requirement. Also, sample collection technique must be consistent and in compliance to procedure outlined in the FSAP. In addition, chemical data reported from quarterly samples will be evaluated for trends and outliers over the specified period in each FSAP. The evaluation will be conducted by observation and statistical procedures such as student test and distribution patterns. When the results reveal no change in data over the specified period of time, the data will be assumed sufficient to characterize the soil, groundwater, or soil-vapor conditions. Representativeness is addressed in the RI/FS Work Plan and Field Sampling and Analysis Plan (FSAP) where rationale for sampling locations is discussed.

### 4.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one set of data can be compared to one another. To achieve this goal, standard techniques will be applied to collect, analyze, and evaluate representative samples by reporting results in appropriate units. To achieve this goal, the following measures will be used while collecting samples:

- Appropriate selection of sampling and analysis procedures;
- Standardized written sampling and analysis procedures; and
- Standardized handling and shipping procedures.

All sample collection and analyses will be performed using the same technique and method. This approach will minimize systematic laboratory or field errors that may occur during implementation of field and laboratory procedures. The analyses methods, sample handling and shipping procedures will be in accordance with the information in appendix B of this document.

### 4.1.5 Completeness

Completeness is the percentage of reported data that is usable. A high level of completeness will be achieved by ensuring that work is performed by properly trained personnel who know and understand the project's specific objectives in both the field and laboratory. For this project, a minimum of 90 percent completeness must be achieved for qualitative Risk Assessment, completion of Record of Decision (ROD), or criteria for evaluating the need for corrective action.

At 90 percent completeness, the data generated from sample analysis will be representative of the actual site condition. This conclusion is based on the assumption that a specific analyte/compound is normally distributed using a two tail t-test. If the goal is not met, evaluation for the need of additional data will be assessed by the NDPM.

## 5.0 SAMPLING PROCEDURES

The purpose of sampling is to obtain data that represent the condition being evaluated. Specific protocols for sampling are developed for each task and are included in each FSAP. These protocols describe procedures for acquiring samples that best represent the environmental matrix. Trace-level contamination of samples from external sources must be controlled through proper selection of sampling equipment and following good sampling practice and decontamination procedures. Great care is required while using measuring and sampling devices that come in contact with the matrix to be analyzed.

The sampling procedures are based on those contained in the United States Environmental Protection Agency, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, September 1986; Soil Sampling Quality and Analysis Plan for Performing a Remedial Investigation for Operation methods, EPA/540/P-87/001; JPL FSAP, Section 6.0.

To develop a task-specified sampling plan, the following concepts will be emphasized:

- Reasons for choosing sampling sites
- Description of sampling sites
- Number of samples
- Sampling methodologies
- Container preparation
- Blank preparation
- Sample preservation
- Storage
- Instructions for transport to the laboratory

The sampling requirements as described in EPA or similar documents specified above will be used in developing the sampling control procedures. General descriptions of sampling

procedures that will be considered during the development of the task technical plans are described below.

## 5.1 SAMPLE COLLECTION

Each element of a field sampling program has its own sample collection requirements. Detailed descriptions of the field-sampling procedures for each of the matrices to be sampled will be presented in the FSAPs for each OU.

These may include the following:

- Groundwater
- Sediment/soil
- Soil vapor

### 5.1.1 Procedures

This section describes minimum procedures for groundwater, soil and soil-vapor sampling. These procedures outline basic steps required during sampling. A detailed summary of the sampling locations and specific number of samples to be collected will be provided in the RI/FS Work Plan and OU FSAPs.

### 5.1.2 Groundwater

Groundwater samples for metals analysis (including hexavalent chromium, strontium, anions, and cations) will be sent to the laboratory unfiltered. During the RI, at the discretion of NASA and in addition to the unfiltered samples filtered samples for metals analyses (including hexavalent chromium, strontium, anions and cations) will be sent to the laboratory for analyses. To collect the filtered samples a disposable 0.45 micron filter will be attached to the end of the

discharge hose of the pump, or to the end of the Westbay sampling bottles, before the samples are collected. The pump will drive the water through the filter when the shallow wells are sampled, and a manually operated hand pump will be used to drive the water through the filter when the deep multi-port wells are sampled.

Samples for volatile organic compound (VOC) analysis shall be collected using either a submersible pump (dedicated or non-dedicated), bottom-loading stainless steel or Teflon bailer with a bottom emptying device or flow control device for the bottom of the bailer, or through the specialized multiport sampling device. Vials shall be filled by pouring the sample down the sides of the container with as little turbulence as possible. Vials shall be filled completely and immediately capped without any air space in the vial. The vial shall then be inverted, and tapped to check for air bubbles. If an air bubble is observed in the vial, a new sample must be collected. The remaining sample is not to be topped off. All VOC samples will be wrapped in bubble-wrap material for transport to the laboratory.

For this program, the following types of components will be analyzed in selected groundwater samples:

- Volatile Organics
- Semivolatile Organics
- Metals (Title 26 Metals) plus Strontium
- Anions and Cations
- Alkalinity
- Total Dissolved Solids
- Hexavalent Chromium
- Cyanide
- Total Petroleum Hydrocarbons
- Radioactivity (Gross Alpha/Beta)

### 5.1.3 Soils

General soil sampling procedures are outlined in Soil Sampling Quality Assurance User's Guide, EPA-600/4-84-043, May 1984. Soil borings shall be logged for soil type according to the

Unified Soil Classification System (USCS). Soil samples shall be sent to the laboratory for chemical analysis. In cases where multiple soil analyses are required (i.e., metals or total petroleum hydrocarbons [TPH]), either duplicate soil samples must be obtained for the additional analyses, or the samples must be analyzed for VOCs and TPH (if applicable) before any other analyses are conducted. Samples used for field screening are not to be submitted to laboratories for analysis. Boring logs shall contain all pertinent information, such as

- Odors,
- Organic vapor analyzer (OVA) data, and
- Percent sample recovery in sampling sleeves.

Section 6.0, "Sampling Equipment and Procedures" contained in each FSAP, describes in detail the soil sample collection procedure and the boring log information required for this project.

### 5.1.4 Sample Containers/Cleaning Procedures

For each media sampled the sample volume and containers used will depend upon the following:

- The number of analyses to be performed on a sample;
- The concentration of the contaminants of interest; and
- An adequate volume of sample will be taken to perform analytical replicates and spikes on a minimum of 5 percent of the samples taken.

Details of suggested sample container sizes for the most commonly analyzed target compounds/analytes for soil and water samples are provided in Appendix B of this text.

All sample bottles will be cleaned according to procedure outlined in the EPA, User's Guide to Contract Laboratory Programs, Washington, D.C., December 1986. The laboratory performing the analyses will be responsible for supplying properly decontaminated bottles for field sampling.

### 5.1.5 Sample Preservation

Sample preservation from the time of collection until the analyses are performed is important to maintain sample integrity. Before transportation and storage of the sample, it will be preserved using the preservation techniques and procedures recommended by the EPA, User's Guide to Contract Laboratory Programs, Washington, D.C., December 1986. Sample preservation will be performed in the field by a qualified sampling technician trained in the preservation techniques for all media of concern. Once collected and labeled, all samples will be immediately stored in cold chests at or below 4 degrees Celsius using ice to maintain the temperature. The coolers will contain thermometers for monitoring cooler temperatures. Details of the sample preservation and shipping is provided in each FSAP. Sample preservation requirements for the most commonly analyzed target compounds/analytes are contained in Appendix B of this QAPP.

### 5.1.6 Field Sample Identification Procedure

Samples collected in the field will be sealed with a tamper proof-seal (Figure 5-1) and clearly identified on a sample label (Figure 5-1) affixed to the sample container and a sample tag (Figure 5-1) that is also attached to sample containers. Each sample label and Chain-of-Custody Form (Figure 5-2) will contain the following information:

- Site Location
- Sample Identification
- Preprinted Sample Tag Number
- Date of Sample Collection
- Time Sample Collection
- Sample Depth (as appropriate)
- Sample Technician — Name and Signature of Sampler
- Analyses Requested

# FIGURE 5-1

TAMPER PROOF SEAL

| | |
|---|---|
| SAMPLE NUMBER | DATE |
| SIGNATURE | |
| PRINT NAME AND TITLE | |

SAMPLE LABEL

| | |
|---|---|
| Project/Site Name | |
| Sample No. | |
| Collected By | Remarks |
| Date | Time |
| Sample Description | |
| Analyses Requested: | |
| Preservatives Used: | |

FIGURE 5-1 (Continued)

SAMPLE TAG

<table>
<tr><td>ANALYSES</td><td>√</td><td>Site Type</td><td colspan="2">Site Identification</td><td rowspan="9">JET PROPULSION LABORATORY<br>ENVIRONMENTAL AFFAIRS AND<br>CHEMICAL CONTROL OFFICE</td></tr>
<tr><td>Volatile organics (GC/MS)</td><td></td><td>Date</td><td>Time</td><td>Sample Depth (ft.)</td></tr>
<tr><td>Semi-Volatile organics (GC/MS)</td><td></td><td>Sample Technique</td><td colspan="2">Sample Tag No.</td></tr>
<tr><td>Total Metals (ICP, GFAA, CVAA)</td><td></td><td colspan="3">Sampler's Signature</td></tr>
<tr><td>Anions</td><td></td><td colspan="3" rowspan="7">Remarks<br><br>☐ Preserved with _____</td></tr>
<tr><td>Radiological Parameters</td><td></td></tr>
<tr><td>Cations</td><td></td></tr>
<tr><td>Alkalinity</td><td></td></tr>
<tr><td>Total Petroleum Hydrocarbons</td><td></td></tr>
<tr><td>Selected Metals</td><td></td></tr>
</table>

## CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

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| | |
|---|---|
| Project : | OFS No. |
| Project Address: | |
| Sampler (Name): | Sampler: *(Signature)*: |
| Laboratory: | |
| Reports to Be Sent to: | |

HAZARD IDENTIFICATION:
Nonhazard ☐ Reactive ☐
Flammable ☐ Toxic ☐
Skin Irritant ☐ Infectious ☐

Time Required
NORMAL ☐ ____ DAYS
RUSH ☐ ____ DAYS

ANALYSES REQUIRED

| SAMPLE NUMBER | TIME COLLECTED | DATE COLLECTED | NUMBER OF CONTAINERS | CONTAINER SIZE(S) | SAMPLE MATERIAL | | | LOCATION | DEPTH | QC CODE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WATER | SOIL | OTHER *(Describe)* | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

THE INFORMATION IN THIS SECTION WILL NOT BE AVAILABLE TO THE LABORATORY

LABORATORY INSTRUCTIONS/COMMENTS:

SAMPLING COMMENTS:

| Relinquished by: *(Signature)* | Date: | Received by: *(Signature)* | Relinquished by: *(Signature)* | Date: | Received by: *(Signature)* |
|---|---|---|---|---|---|
| Company: | Time: | Company: | Company: | Time: | Company: |

F-2

*Shipping Copy (White) File Copy (Canary) Field Copy (Pink)*

**FIGURE 5-2**

**SAMPLE CHAIN-OF-CUSTODY FORM**

- Preservation Notes
- Sample Tag Number
- Remarks — Pertinent Observations of the Samplers

The Chain-of-Custody Form will accompany the samples during transport and be signed.

### 5.1.7 Sample Designation

The sample identifiers used for the soil samples collected during the drilling of the proposed monitoring wells (see FSAPs) will also consist of a unique alpha-numeric code identifying the sample type. Each sample of soil will be identified with "S" (soil), followed by a numeric identifier. The numeric identifier will be "1" for the first sample collected and will increase sequentially as additional samples are collected. The time, location, and depth of all soil samples will be recorded on the boring log forms and in the permanently-bound field log book.

### 5.1.8 Field Quality Control Procedures

Field QC will be applied and enforced during sample collection, storage and transportation, and during equipment decontamination. The analytical results obtained from QC samples will be used to qualify field sample results during data validation. Procedures for field QC sampling are described in the following subsections.

#### 5.1.8.1 Field Blanks

Field blanks will be used to determine potential contamination resulting from field conditions. Field blank will consist of sample bottles filled with ASTM Type II organic free water and will be prepared by the sampling team before samples are collected. The sample bottle will be uncapped at the beginning of sampling activities and remain so until sample collection is

completed. The blank water is capped and packaged for shipment to the laboratory. Field blank will be collected at a frequency of one per sampling round. All blanks will be analyzed for the same chemical parameters as the actual field samples collected on the same day.

### 5.1.8.2 Equipment Blanks

An equipment blank is ASTM Type II organic free water that is poured into or pumped through decontaminated sampling equipment and collected in a sampling container. The equipment blank will identify sample contamination that is associated with improper sampling equipment decontamination, bottle contamination, or contamination associated with bottle or sample shipment. The equipment will not, on its own, identify the exact source of contamination. The equipment blank will be collected at a frequency of one per day, per type of equipment (see Table 5-1). All blanks will be analyzed for the sample chemical parameters as the actual field samples collected on the day.

**TABLE 5-1**

**GUIDELINES FOR MINIMUM QA/QC SAMPLES FOR FIELD SAMPLE COLLECTION**

| MEDIA | FIELD DUPLICATE | EQUIPMENT BLANK | TRIP BLANK | FIELD BLANK |
|---|---|---|---|---|
| Aqueous | one in twenty | one per day per type of equipment | one per VOA shipment | one per sampling round |
| Soil, Sediment | one in twenty | one per day per type of equipment | N/A | one per sampling round |

### 5.1.8.3 Trip Blanks

Trip blanks will be used to determine potential contamination resulting from the transport and storage of samples. Trip blanks will consist of sample bottles filled with deionized water, and will be prepared by the laboratory. Each trip-blank bottle will be transported to the sampling

site, and will remain capped in ice chests during sample collection. One trip blank will accompany samples taken on any single day. Groundwater samples requires a trip blank for VOC analyses for each shipment of samples taken on any single day.

### 5.1.8.4 Field Duplicate

A field duplicate is a second sample collected from the same location. The field-duplicate sample provides the data user with information about the measure of precision between the two samples. A lack of precision may indicate that the sample matrix is not homogeneous or that the sampling and analytical procedures are not capable of providing consistent results. If the results of the duplicate analyses do not fall within the control limits specified for the analysis, actions shall be taken to correct the situation; the data can only be used as long as the limitations are recognized.

Field duplicate samples will be evaluated by calculating Relative Percent Difference (RPD), using the equation:

$$RPD = \frac{S_1 - S_2}{(S_1 - S_2)/2} \times 100$$

where $S_1$ and $S_2$ are duplicate samples.

For this project, the control limit of $\pm$ 20 percent for water, and $\pm$ 35 percent for soil will be adapted. Sample results exceeding these limits will be used with consideration of the variability that exists due to such factors as sample heterogeneity. These samples will be labelled such that the laboratory will not know which samples are duplicates. Field duplicate samples shall be collected at a rate of one sample per week or 5 percent/parameter/matrix/laboratory/site, whichever is greater.

## 5.2 SOIL-VAPOR INVESTIGATION

The soil-vapor investigation is an important part of the project. The State of California requirements and operating procedures for soil gas investigation and specific compounds of interest including recommended detection limits are listed in Appendix A of this QAPP.

The objectives of the soil gas investigation are the following:

- Evaluate potential contaminant source locations which may have impacted groundwater;
- Estimate variation and extent of soil contamination; and
- Aid in determining the potential efficiency and appropriate design for soil sample or soil-vapor well collection points.

At a minimum, the standard operating procedures (SOP) will include the following:

- Daily calibration method for the GC;
- Blank analysis;
- Laboratory quality control check sample analysis and frequency of this analysis during each day;
- Corrective procedures to address sample concentrations outside the linear calibration range of field or laboratory;
- Confirmation of compounds detected using second column;
- Duplicate analysis of samples;
- The holding time of the samples;
- Sample identification;
- QA/QC corrective actions; and
- Report generation.

### 5.2.1 Sample Collection

Soil-vapor samples will be collected at a minimum depth of 5 feet below ground surface to minimize atmospheric-air interference at each location based on site conditions. The FSAP for OU-2 will provide more detailed information regarding sample collection and handling procedures than are summarized in this QAPP.

### 5.2.2 Soil Vapor Sample Identification Procedures

The sample identifiers used for soil-vapor samples will consist of a unique alphanumeric code. Sample names for soil vapor samples will include the acronym SV (soil vapor), followed by a number indicating the sequence in which the probe was installed and sampled (e.g., SV-1). The sample identifier used for soil-vapor samples collected from the nested vapor wells will include the acronym VP for vapor probe, followed by SV, followed by a number indicating the sequence in which the probe was installed and sampled (e.g., VPSV-1). The sample identifier for soil samples will use the acronym SS (soil sample), followed by a number indicating the sequence in which the sample was collected (e.g., SS-1). Soil samples collected during the installation of each vapor well will be labeled with VP followed by SS, followed by the sequence in which the sample was collected (e.g., VPSS-1).

Duplicate soil-vapor and soil samples will also be labeled sequentially as they are collected (e.g., SS-2 or VPSS-2). Equipment blanks will be labeled with the acronym WS (water sample) followed by a number indicating the sequence in which it was collected (e.g., WS-1). This sample designation system will be used to keep each sample location and depth, as well as the identification of any QA/QC samples, unknown to the laboratory conducting the analyses. For record keeping purposes, the sample identifiers will be recorded on the chain-of-custody and in the permanently bound field log book. The permanently bound field log book will also contain each sample's location, depth, and whether it was a QA/QC sample or not (i.e., duplicate, equipment blank, water truck, Baker tank, etc.).

### 5.2.3 Sample Analysis

An on-site mobile laboratory with laboratory-grade gas chromatograph instruments will be used for sample analysis. Detection limits of 0.1 to 1.0 $\mu$g/l will be attained. When detection limits cannot be achieved, justification for the detection limits reported will be documented. The analyst will ensure that instrument operating conditions and parameters are optimized to provide maximum analytical performance.

### 5.2.4 Quality Assurance/Quality Control Procedures

Soil-vapor investigation is a preliminary step to full-scale sample collection and analyses. The chemical data generated from field instrument will be considered less reliable than the laboratory data. The QA/QC procedures for the soil-vapor analysis shall be in accordance with the requirements issued by the California Water Quality Control Board, Los Angeles Region (October, 1992).

Initial Calibration

Initial calibration will be performed for all compounds listed in Appendix A of this QAPP. A minimum of three concentrations will be performed with the lowest concentration not higher than three times the Method Detection Limit (0.1 to 1.0 $\mu$g/l). Identification and quantification of compounds will be based on the same operating conditions of the instrument as they were during calibration using the same column and detector under the same temperature, gas flow, etc. Any change in the instrument condition of standard chemical used for calibration will require a new initial calibration.

Daily Calibration

A one-point (mid-point) calibration sample, containing nine calibration standards, including three aromatics and six halogenated compounds, will be analyzed at the beginning of each working day. These compounds shall be selected to represent short, medium, and long retention time groups of the compounds listed in Appendix A. This one-point calibration check will be performed for all compounds detected. If a compound detected is not on the list of calibration compounds selected, an additional calibration shall be performed for the compound. To ensure that instrument performance is at optimum, the response factors for the daily calibration compound must be within 15 percent of the corresponding value for the three-point (initial) calibration, otherwise the GC will be re-calibrated.

Blanks

Blank samples, such as ambient air, are designed to monitor cross contamination that may occur due to sample handling, instrument carry-overs, or general environmental conditions. All blanks will be analyzed at the beginning of the working day and as frequently as necessary during the rest of the day.

Quality Control (AC) Check Sample

A minimum of two QC check samples will be analyzed every 10 to 15 environmental samples, one at the beginning and one at the end of each sample batch. The QC check samples shall include the nine compounds or the same list of compounds as in the daily calibration. Response factors for each compound must be within 20 percent of the corresponding true value (compared to the calibration response factor). If the initial check sample fails the requirement, the problem will be determined and resolved before proceeding with sample analysis. Similarly, if the end check sample fails, all environmental samples prior to the analysis will be considered questionable and will not be accepted.

Compound Identification

Every compound detected or reported during the soil-vapor analysis will be confirmed using a second column or GC/MS. Usually, one sample will satisfy this requirement and quantification will not be performed for the confirmation analysis.

### 5.2.5 Soil Vapor Data Reporting

The data report will include the requirements listed below:

- The date and time of injection, and analytical conditions must be provided for all environmental and QA/QC samples.
- All concentrations must be reported in $\mu$g/l.
- For (the most recent) initial calibration, the retention time and average response factor (RF) for each compound must be reported.
- For daily one-point calibration, the RF and percent difference from initial RF for each compound must be tabulated and reported.
- For QC check samples, the true concentration, detected concentration, and percentage difference for each compound must be tabulated and reported.
- For environmental samples, including any duplicates, the sample identification, sampling depth, purge volume, vacuum pressure, sampling time, injection time, injection volume, results, and any other sampling or analytical remarks, must be reported in a tabulated format. Unidentified or tentatively identified peaks must also be listed.
- Chromatograms for calibration standards, QC check samples, and field samples will be documented.

The data will be reported using the forms contained in the soil-vapor SOP provided in Appendix A of this QAPP.

## 5.3 DECONTAMINATION OF FIELD SAMPLE COLLECTION EQUIPMENT

All sampling equipment used in the collection of groundwater samples at JPL will be decontaminated prior to use. Personnel directly involved in sampling equipment decontamination will wear protective clothing as specified in the Health and Safety Plan.

**Pump Decontamination**

The shallow groundwater monitoring wells at JPL will be sampled with a 2-inch Grundfos Redi-flo2® pump. Before a 2-inch pump supplied by a subcontractor is used to sample the shallow wells, it will be disassembled, its interior washed with a non-phosphate detergent (such as Liquinox®) solution for organic constituents, an acid detergent (such as Citronox®) solution for metals, and rebuilt using new parts. The associated subcontractor's discharge hose will be replaced by either 250 feet of new hose or by a similar length of discharge hose which had previously been dedicated to JPL wells. A new check valve or one which has only been used in JPL wells may also be installed above the pump on the discharge hose. If dedicated 2-inch pumps are installed, these decontamination procedures will not be required before each sampling event.

The decontamination procedures described below will be used prior to sampling each shallow monitoring well at JPL after the pump has been rebuilt and the discharge hose has been replaced.

- Steam clean the exterior surfaces of the pump and lower 20 feet of the discharge hose using potable water.
- Remove the plug at the bottom of the pump and drain the water from the coolant reservoir for replacement later with fresh deionized or distilled water.
- Decontaminate the interior of the pump and discharge hose by first pumping a solution of potable water and non-phosphate detergent (Liquinox®) through the pump and discharge hose for 5 minutes followed pumping a solution of an acid detergent (Citronox®) and potable water through the pump and discharge hose for 5 minutes. The solutions of detergent and water will be contained in separate large, steam

cleaned plastic trash cans. Second, rinse the interior of the pump and discharge hose by pumping potable water through the system for 5 minutes. The rinse water will also be contained in a large plastic trash can that has been steam cleaned prior to use. Finally, rinse the interior of the pump and hose a second time by pumping distilled or deionized water through the system for 5 minutes. The distilled or deionized water will also be contained in a large, steam cleaned, plastic trash can.

- Refill the pump's coolant reservoir with distilled or deionized water and replace the plug at the bottom of the pump.
- Collect an equipment blank from the end of the discharge line of the pump if required.

Before the installation of dedicated 2-inch Grundfos Redi-flo2® systems in each shallow monitoring well at JPL, it will be necessary to follow the decontamination procedure outlined above and collect an equipment blank from each pump. Thereafter, it may only be necessary to decontaminate the short discharge hose which connects the well head to the area where the samples are collected. This will be accomplished by washing the interior and exterior of the hose in distilled or deionized water containing a non-phosphate detergent solution, then an acid detergent solution and then rinsing the hose twice with distilled or deionized water. The detergent solutions and rinse water will be contained in plastic buckets which will have been decontaminated in a similar fashion.

**Bailer Decontamination**

Disposable Teflon® bailers and non-disposable stainless steel and/or Teflon® bailers may at some time be used to sample the shallow monitoring wells at JPL for various reasons. Although disposable bailers and their bottom emptying device are precleaned by the manufacturer, the bailers and emptying devices will be rinsed with distilled or deionized water prior to any use. Prior to the use of non-disposable bailers, the decontamination procedures described below will be used.

- Disassemble the bailer and wash each component in a solution of non-phosphate detergent (Liquinox®) and distilled or deionized water followed by washing each component in a solution of an acid detergent (Citronox®) and distilled or deionized

water. The interior surfaces of the bailer can be washed by pushing lint-free paper wipes (such as Kim Wipes®) through the bailer with a clean wooden dowel. The exterior surfaces of bailers and small parts will be scrubbed using a clean plastic brush.

- Rinse the bailer and its components twice with distilled or deionized water.
- Reassemble the bailer and collect an equipment blank, if required.

**Westbay Sampler Decontamination**

The Westbay sampling probe and sample bottles will be decontaminated prior to the sampling of each screened interval in each deep MP well. Before Westbay equipment that has been rented is used at the site, the interior of the hoses used to connect the 250-ml sample bottles will be lined with new 1/8-inch OD Teflon® tubing. If the Westbay equipment has been dedicated, this procedure will not be required. The threaded stainless steel sample bottles (tubes) will be decontaminated using the same procedure outlined above for non-disposable bailers. The Westbay sampling probe, and the valves and Teflon®-lined hoses connecting the sample bottles will be decontaminated by the following procedures.

- The interior surfaces of the Westbay sampling probe, and the hoses and valves associated with the Westbay sample bottles will be decontaminated by forcing several volumes of a non-phosphate detergent (Liquinox®) and distilled or deionized water solution through them followed by forcing several volumes of an acid detergent (Citronox®) and distilled or deionized water solution through them with a clean plastic squeeze bottle used only for this purpose.
- All components will be rinsed by forcing several volumes of distilled or deionized water through them with a clean plastic squeeze bottle used only for this purpose.
- Collect an equipment blank, if required.

## 6.0 SAMPLE CUSTODY

To maintain and document sample possession, chain-of-custody procedures are required. These procedures are necessary to ensure the integrity of samples from collection to data reporting. Chain-of-custody provides the ability to trace possession and handling of samples from the time of collection through analysis and data deposition. The information in this section defines custody as it applies to this project.

## 6.1 FIELD CUSTODY

Field sample custody is initiated immediately after samples are collected. The NASA Authorized Subcontractor Operable Unit Manager (OUM) or the designee is responsible for sample safety and will ensure that the samples are properly transferred from the field to the laboratory via overnight courier service. A sample is considered under custody if:

- It is in your possession, or
- It is in your view after being in your possession, or
- It was in your possession and you locked it up, or
- It is in a designated secure area.

Personnel collecting samples are personally responsible for the care and integrity of these collected samples until they are properly transferred or dispatched. Therefore, the number of people handling a sample should be kept to a minimum.

A Chain-of-Custody Form is completed by the sampler prior to release. All samples collected must be recorded in the Chain-of-Custody. The sampler will sign the form where indicated and record site type, site identification, sample date, time, and sample depth (as appropriate) for each sample collected. Each Chain-of-Custody Form will be completed to the extent possible prior to sampling. The NASA Authorized Subcontractor Manager OUM will instruct the sampler on

## FIGURE 6-1

## HAZARDOUS SUBSTANCE NOTIFICATION LABEL

**HAZARDOUS SUBSTANCE**
**SOLID OR LIQUID**
**REFERENCE NUMBERS**

NASA Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109
(818) 354-0180

**FORM-E**

NA9188

what analyses are required for each sample. The OUM will check off each sample analysis required on the chain-of-custody form to ascertain that information on both documents are consistent. Only when the chain-of-custody has been verified, may the sampler relinquish custody of the samples.

## 6.2 TRANSFER OF CUSTODY

When transferring custody of samples, the individuals relinquishing custody and receiving custody will sign, date, and record the time on the Chain-of-Custody Form. The Chain-of-Custody Form documents the transfer of samples from the sampler to the analytical laboratory. The procedures for executing transfer of custody and sample shipment in a hypothetical secured area are outlined below.

1. To transfer a sample from the contamination area to the support zone, the sampler will relinquish custody of samples to the OUM or designee for packaging and shipment. This transfer will occur in the Contamination Reduction Zone (CRZ) in the vicinity of the decontamination area or at the site of the investigation. The OUM or designee will check the information on the sample tags and Chain-of-Custody Form for completeness and consistency. The sample number, date, sample, and the sample identification number will be entered into the Sample Control Log.
2. The OUM or designee will sign a tamper-proof seal indicating the sample number, date, time, and place collected. The OUM or designee will place the sample in a plastic ice chest with packages of ice tightly packed with suitable packing material. The original Chain-of-Custody Form will be signed, dated, and the time recorded by the OUM or designee prior to transferring custody for shipment. A notation will be made in the remarks section of the record indicating method of shipment, courier's name, and other pertinent information. The Chain-of-Custody Form will be sealed in a waterproof envelope and a tamper seal will be placed on the envelope flap. The envelope will be taped to the inside of the ice chest with the name and address of the receiving laboratory prominently displayed. The ice chest will be taken directly to the shipping agent by the OUM or designee and custody relinquished to the shipping agent.
3. The OUM or designee will close and seal the ice chest with a tamper-proof seal. The OUM or designee will fill out the ice chest's tamper-proof seal as described above with the exception that the sample number will not be necessary since several samples may be placed in each ice chest. The seal will be attached to the ice chest

in such a way that it is necessary to break it to open the ice chest. Tamper-proof seals must be applied to sample containers and ice chests by the OUM or designee. The ice chest will be taped closed by wrapping each end at least twice with either fiberglass reinforced tape or a strong adhesive tape. Paper tape or "Scotch" tape will not be allowed.

4. The OUM or designee will affix a Hazardous Substance Notification Label (Figure 6-1) prominently on the ice chest. The OUM or designee will indicate that the hazardous substance in the container is either a solid or liquid by crossing out the inappropriate term with a black pen. For those ice chests not having a courier's documentation, the laboratory address sticker will be affixed to the top of the cooler.
5. Shipped samples must be accompanied by the original Chain-of-Custody Form. The OUM or designee will be responsible for the distribution of the chain-of-custody information. One copy is to be placed in the field files and the other copy will be sent to the NASA Designated Quality Assurance Officer (QAO) and a copy to the NASA Designated Project Manager (NDPM).

## 6.3 LABORATORY CUSTODY

The process of sample custody in the laboratory will be maintained using sign-on/sign-off sheets and/or bound notebooks kept at designated locations. The custody documents will identify and provide the following information:

- Name of the person having the sample
- Type of sample removed
- Date and time sample was removed
- Reason for sample removal
- Date and time sample was returned
- Person's name and/or initials

The details of this procedure and the design or log-in/log-out documents will be contained in laboratory-specific QA plan.

# 7.0 ANALYTICAL PROCEDURES

The choice of an analytical laboratory or analytical laboratories used during the RI will depend upon the data quality objectives for a particular task, the ability of the laboratory to perform a particular analytical method, and the acceptability of the laboratory's QA program. The analytical methods, both qualitative and quantitative, implemented at the laboratory will comply with EPA or other approved methods. The analytical laboratory used will be selected from a list of laboratories certified by the California Department of Health Services (CDHS). The list of analytes/parameters for this project is included in Appendix A of this document. Only labs having state certification for a given analyte will be used for that analyte. Additional details on Analytical Procedures are in Table 1 of Appendix B.

## 7.1 ANALYTICAL METHODS

This section briefly describes the analytical methods for target analytes that will be performed by a CDHS certified laboratory. The instrument quality control procedure and criteria for the various analyses are provided in Table 7-1. The described procedure for the method satisfies both EPA and the state requirements. Detailed method descriptions will be available from the laboratory performing the analysis.

### 7.1.1 GC/MS Techniques

Volatile Organic Compounds (VOCs)

Water and soil samples analyzed for VOCs will be performed by Gas Chromatography/Mass Spectrometry (GC/MS) instrumentation in accordance with EPA, state or approved standard methods as specified in Appendix B of this document. This method requires that a sample spiked with the required surrogates and internal standards be introduced into the gas chromatography via a purge-and-trap mechanism. An inert gas is bubbled through the sample

# TABLE 7-1

## ANALYTICAL INSTRUMENT QA/QC PERFORMANCE CRITERIA

| Method | EPA 500 Series Method 524.2 Volatile Organics | SW-846 Method 9010 & 9012 Total Cyanide | SW-846 Methods 7470/7471 Mercury by Cold Vapor |
|---|---|---|---|
| QC Check Standards | Analyze a QC check standard with every 20 samples or one per sample set. %R = 80-120 | Verify calibration with an independent check standard. If not within ± 15% of expected value, recalibrate. | Verify calibration with an independent check standard. %R = 90 -110 |
| Initial Calibration | 3, 4, 5 levels (depending on calibration range) lowest 2-10 times MDL. If % RSD <20, linearity assumed and average RF used. | Colorimetric: standard at 6 levels plus blank. | Standard at 5 levels plus a blank. |
| Continuing Calibration | Mid-level calibration standard analyzed at the beginning of each 8-hour shift. RF must be within ±30% of initial calibration. | Colorimetric: verify curve with every sample batch by analyzing a mid-level concentration standard. | Analyze a mid-level calibration standard or QC check standard after every 10 samples. %R = 80-120. |
| Surrogate Standards | 4-Bromofluoro-benzene Recovery limits for BFB 86-115% | Not Applicable | Not Applicable |
| Accuracy/Precision | One MS/MSD per 20 samples. | One MS/MSD per sample batch. | One MS/MSD per batch of samples. Processed at same time. %R = 75-125 %RPD <20 |
| Blank | One method blank per batch of samples processed together. | Titration-one reagent blank per sample batch colorimetric-calibration blank. | One method blank per batch of samples, one calibration blank with curve. |
| Other Criteria Method Specific | 50 mg bromo-fluorobenzene (BFB) at the beginning of each 8-hour shift.<br><br>All ions >10% intensity must be ± 20% of standard ion; Sample RT within 3 standard deviation of RT in calibration. | Distill a high standard; results should be ± 10% of undistilled concentration. | Use MSA to compensate for matrix interferences. |

# TABLE 7-1

## ANALYTICAL INSTRUMENT QA/QC PERFORMANCE CRITERIA

(Continued)

| Method | SW-846 Method 7000 Series Trace Metal by Flame and GFAA | SW-846 Method 6010 Trace Metals by ICP |
|---|---|---|
| QC Check Standards | Verify calibration with an independent check standard. %R = 90 -110 | Verify calibration with an independent prepared check standard. |
| Initial Calibration | Minimum standard at 3 levels plus a blank. | Minimum standard at 3 levels plus a blank. |
| Continuing Calibration | Analyze a mid-level calibration standard or QC check standard after every 10 samples. %R = 80-120 | Analyze mid-level calibration standard after each 10 samples. %R = 90-110 |
| Surrogate Standards | Not Applicable | Not Applicable |
| Accuracy/Precision | One MS/MSD per batch of samples. Processed at same time. %R = 75-125 %RPD <20 | One MS/MSD per batch of samples. Processed at same time. %R = 75-125 %RPD <20 |
| Blank | One method blank per batch of samples, one calibration blank with curve. | One method blank per batch. Analyze calibration blank after 10 samples. |
| Other Criteria Method Specific | Test for matrix interference with each matrix using serial dilution (if >25X detection limit) or post-digestion spike. | Analyze ICS at beginning and end of run or twice during 8-hour shift. Results ± 20%<br>Reanalyze highest standard after calibration results ± 5% of true value for each new matrix, if analyte >10X 1DL dilute 1:4. Dilution should be ± 10% of original. |

## TABLE 7-1

## ANALYTICAL INSTRUMENT QA/QC PERFORMANCE CRITERIA

| Method | SW-846 Method 8240 Volatile Organics | SW-846 Method 8270 Semi-Volatile Organics | EPA Method 200 Series |
|---|---|---|---|
| QC Check Standards | Analyzed a QC check Standard with every 20 samples. | Analyze a QC check standard with every 20 samples. | Verify calibration with an independent check standard. Standard % R = 90 - 110% |
| Initial Calibration | Minimum of 5 levels, lowest near but above MDL. % RSD for CCCs < 30 Rf for SPCC > 0.30 (0.25 for bromoform) | Minimum of 5 levels, lowest near but above CDL. % RSD for CCCs < 30. RF for SPCC > 0.05 | Minimum of 3 levels plus a blank. |
| Continuing Calibration | Mid-level calibration standard run every 12 hours. Rf for SPCCs same as for initial calibrations, RF for CCCs must be < 25% difference from initial calibration. | Mid-level calibration standard run every 12 hours. RF for SPCCs > 0.05 Rf of CCCs must be < 30% difference for initial calibration. | Analyze a low level standard daily or every 20 samples, whichever is more frequent. % R = 90 - 110 |
| Surrogate Standards | 4-bromofluorobenzene, 1, 2-dichloroethane-$d_4$, and toluene-$d_8$ Recovery limits 85-115% | Nitro benzene-$d_5$, 2-fluorophennal, and 2, 4, 6-tribromophenol. Recovery limits 85-115% | Not Applicable |
| Accuracy/Precision | One MS/MSD per 20 samples. | One MS/MSD per 20 samples or each batch of samples which ever is more frequent. | One duplicate sample per every 10 samples or per set of samples (if sets contain less than 10). % R = 90 - 110% |
| Blank | One Blank per batch or samples processed together. | One method blank per 20 samples or each extraction batch of samples, whichever is more frequent. | Method blank not specific. However, one blank per batch of sample, one calibration blank with curve. |
| Other Criteria Method Specific | 50 mg bromofluorobenzene (BFB) at the beginning of each 8-hour shift.<br>All ions > 10% intensity must be ±20% of standard ion; sample RT within 3 standard deviation of RT in calibration. Library search must made for the purpose of tentative identification. | Tune with 50 MG decafluoro-triphenyl phosphini, DFTPP) initially and every 12 hours.<br>All ions > 10% intensity must be ± 20% of standard ions; sample RT within 3 stnadard deviation of RT in calibration. | For GFAA, verify absence of interferences by detailing and spiking each matrix.<br>Use standard addition to compensate for matrix interferences. |

at the ambient temperature. The vapor is swept through the sorbent column where the compounds are trapped. The compounds are then desorbed by heating and backflushing with inert gas into the GC column for separation and identification on the mass spectrometer.

Semi-Volatile Compounds

Water and soil samples analyzed for semi-volatiles will be performed by GC/MS instrumentation using the specified method in Appendix B, SW846, Method 8270. This method requires the spiking of matrices (soil and water) with method-specified surrogates at appropriate concentration levels. The samples are then prepared and analyzed as described below.

For water samples, a measured volume of sample is extracted with methylene chloride, evaporated, and concentrated to a final volume of 1 ml. For soil samples, a measured weight of sample is mixed with anhydrous sodium sulfate and extracted with methylene chloride/acetone using an ultrasonic probe. The extract is then concentrated to a final volume of 1 ml. The extracts are analyzed and quantified using GC/MS. The total ion current profile for GC/MS (volatile and semi-volatile methods) will be screened for all major nontarget peaks, including noncertified compounds.

The laboratories will report all non-target analytes with peaks greater than 10 percent of the internal standard response (giving RT [retention time] code, estimating concentrations, and printing mass spectra). Each of these major peaks greater than 10 percent of the internal standard response, excluding obviously meaningless peaks, (e.g., column bleeds) will be reported as to the purity, fit, and probability to match for the three most likely candidate compounds from the EPA/NBS/NIH mass spectral library.

### 7.1.2 Metals Analysis

The analyses of metals (Title 26 metals plus strontium) in water and soil samples will be performed using ICP and atomic absorption spectrophotometer (cold vapor and graphite furnace) instrumentation. All methods for analyses will be in accordance with EPA and State of California requirements. The following are brief descriptions of the methods that will be used:

- The ICP method requires the digestion of a method-specified aliquot or sample and uses nitric acid, hydrochloric acid, and heat to dissolve precipitates that may be present. After heating to the desired volume, the digestate is diluted to a final volume of 50 ml and analyzed for target analytes as requested in the method table.
- Mercury will be analyzed by cold vapor atomic absorption. The method requires that an aliquot of sample be treated with sulfuric and nitric acids, potassium permanganate, and potassium persulfate during digestion. Hydroxylamine sulfate is also added to remove excess permanganate, and stannous sulfate is added to reduce mercury present in the sample. The digested sample is then ready for analysis.
- Lead, selenium, and arsenic will be analyzed by graphite furnace atomic absorption. This method requires digestion of sample using nitric acid, hydrogen peroxide, and a matrix modifier. The analysis is performed according to method certification.

### 7.1.3 Non-Metal Analyses

Applicable laboratory-certified analytical methods for anions and cyanide are briefly described in this section as presented below:

- For water samples the anions (fluoride, bromide and chloride) will be analyzed by IC instrumentation. This method requires that an aliquot of water sample be separated using an anion guard column, separator, and suppressor columns. The compound is eluted using various concentrations of sodium bicarbonate solution and analyzed using a conductivity detector.
- Analysis of cyanide will be performed by the calorimetric method. The method requires that an aliquot of sample be treated with concentrated sulfuric and hydrochloric acid, distilled, and collected in a sodium hydroxide solution. The resulting solution is analyzed using a Technicon Auto Analyzer II equipped with a calorimetric detector fitted with a 570nm filter.

### 7.1.4 Radioactivity

Measurement of Gross Alpha and Beta Particle Activities in Water

The specified method covers the measurement of gross alpha and/or beta particle activities in water or other aqueous fluid. It is applicable to alpha emitters having energies greater than 3.9 MeV and beta particles with Emax greater than 0.1 MeV, where the total dissolved solid content is less than 500 parts per million (ppm). These parameters will be analyzed by EPA method 900 or 9310.

Briefly, the method requires that an aliquot of an acidified water sample be evaporated to a small volume and transferred quantitatively to a tared 2-inch stainless steel counting planchet. The sample residue is dried to constant weight, and counted for alpha and/or beta radioactivity.

Using correction factors for self absorption and back scatter taken from calibration curves, counting data are reduced and results calculated as picocuries (pCi) per unit volume.

### 7.1.5 Alkalinity

Analysis of alkalinity will be performed by the titration method. The method requires that a sample be titrated to an electrometrically determined end point of pH 4.5. The sample must not be filtered, diluted, concentrated, or altered in any way.

### 7.1.6 Hexavalent Chromium

The method for analysis of hexavalent chromium Cr(VI) will be based on separation from the sample by coprecipitation of lead chromate with lead sulfate in a solution of acetic acid. After separation, the supernate is drawn off and Cr(VI) precipitate resolubilized in nitric acid as trivalent chromium Cr(III) and quantified by furnace atomic absorption.

### 7.1.7 Total Petroleum Hydrocarbons (TPH)

TPH will be analyzed using EPA Method 418.1, a spectrophotometric, infrared instrumentation technique. This method is designed to measure fluorocarbon-113 extractable petroleum hydrocarbons from various matrices. This method requires that samples be acidified to a pH less than 2.0 and then extracted with fluorocarbon-113 in a separatory funnel. Interferences from other non-petroleum hydrocarbon materials are removed with silica gel adsorbent. Infrared analysis of the extract is then performed by direct comparison with standards.

# 8.0 DATA REDUCTION, VALIDATION, AND REPORTING

General procedures for data reduction, validation and reporting for the project are presented in this section.

## 8.1 DATA REDUCTION (DOCUMENTATION REQUIREMENT)

The analytical data generated from sample analysis will be present in a format similar to EPA Data Quality Objectives (DQO) Level IV deliverables. All data packages will be Level IV, except for cations, anions, and TPH. The laboratory will be required to include the following in the data package:

**Organic Data**

Section I. Case Narrative

Section II. Chain-of-Custody Documentation

1. Chain-of-custody forms
2. Internal tracking documents, as applicable

Section III. Summary of Results - Forms for the following:

1. Environmental samples, with quantitation limits (include dilutions and re-analyses)

Section IV. QA/QC Results Summaries

1. Initial calibration
2. Continuing calibration
3. Method blanks
4. Surrogate recoveries
5. Matrix spike (MS)

6. Laboratory duplicate or matrix spike duplicate (MSD)
7. Laboratory QC check sample, if applicable
8. Retention time windows
9. Method detection limits (MDL)

Section V. Raw Data - chromatograms and area/quantitation reports

1. Environmental samples (include dilutions and re-analyses)
2. Instrument tuning, for mass spectrometry (GC/MS) analyses
3. Initial calibration
4. Continuing calibration
5. Method blanks
6. Surrogate recoveries
7. Matrix spike (MS)
8. Laboratory duplicate or matrix spike duplicate (MSD)
9. Laboratory QC check sample, as applicable
10. Retention time windows
11. Percent moisture for soil samples
12. Sample extraction and clean-up logs
13. Instrument analysis log for each instrument used

**Inorganic Data**

Section I. Case Narrative

Section II. Chain-of-Custody Documentation

1. Chain-of-Custody forms
2. Internal tracking documents, as applicable

Section III. Summary of Results - Forms for the following:

1. Environmental samples, with quantitation limits (include dilutions and re-analyses)

Section IV. QA/QC Result Summaries

1. Initial and continuing calibrations
2. Method blanks, continuing calibration blanks, and prep blanks
3. ICP interference check sample
4. Matrix spike
5. Laboratory duplicate
6. Laboratory control sample
7. Method of standard additions
8. ICP serial dilution
9. Instrument detection limits
10. ICP linear range

Section V. Raw Data - sequential measurement readout records for ICP, graphite furnace AA, flame AA, cold vapor mercury, cyanide, and/or other inorganic analyses.

1. Environmental samples (including dilutions and reanalyses)
2. Initial and continuing calibrations
3. Continuing calibration and Preparation blanks
4. Matrix spikes
5. Post digest spikes
6. Method of standard additions, when applicable
7. Laboratory duplicate or matrix spike duplicates
8. ICP Serial Dilution
9. Laboratory control samples, when applicable
10. Percent moisture for soil samples
11. Sample digestion and/or sample preparation logs
12. Instrument analysis log, for each instrument used
13. Instrument tuning for ICP-MS, when applicable

## 8.2 DATA VALIDATION

Data validation will be performed in accordance with EPA National Functional Guidelines for Data Validation, February 1988, (Organic and Inorganic) and EPA Region IX specific data validation requirements. This procedure requires verification of sample holding times, preservation, traceability, reported results, cross-contamination, field sample collection, and laboratory analysis procedure. The verification of field and laboratory performance will be accomplished through the evaluation and review of the information listed in Section 8.1 provided by the laboratory.

During the RI/FS soil, groundwater, and soil vapor samples will be collected and analyzed. All soil samples collected and analyzed during the RI/FS whose data will be used as part of the risk assessment and determination of the nature and extent of contaminants of interest will be validated.

Several groundwater sampling events will be conducted during the OU-1 and OU-3 RI/FS. These efforts are intended to assess the nature and extent of contaminants of interest and to evaluate the effects of potentially changing hydrogeologic conditions on contaminant levels. During the initial sampling effort under an agency approved RI/FS program all groundwater samples will be validated to verify laboratory performance. Subsequent to this initial sampling event, 10 percent of all groundwater samples will be validated to confirm laboratory performance. In addition to these samples being validated, all groundwater samples found to contain contaminant levels greater than the permissible Maximum Contaminant Levels (MCL's) will also be validated.

The data validation checklist to be used in this project for evaluating soil and groundwater analyses is included in Appendix E.

Soil-vapor data will be reviewed qualitatively for positive results that are significant for identifying potential VOC source areas. The soil-vapor data generated are less quantitative than laboratory data and difficult to assess the impact of site variables on the detected concentrations. For these soil-vapor data, validation will include an evaluation of standards for instrumental performance throughout the period of analysis and the chromatographic profiles obtained during analysis. Sample results will only be used as a guide for future sample collection to confirm potential contamination.

## 8.3 DATA REPORTING

The following data reports will be provided.

- Laboratory Report — Analytical data packages will be submitted by the laboratory. The sample results will be report in format as described in Section 8.1 Sample results for various analyses will be in units described below.
- Data Validation Report — The findings of data validation will be presented in a narrative report summarizing factors affecting data quality. The report will include data-summary tables with qualifiers advising the data user on the validity of the data for the intended use.

| Water | | Soil | Soil Vapor |
|---|---|---|---|
| µg/l | mg\l | µg/kg | µg/l |
| Metals | Alkalinity | Metals | Volatile Organics |
| Semi-Volatile Organics | | Semi-Volatile Organics | |
| Volatile Organics | | Volatile Organics | |
| Cations | | | |
| Anions | | | |
| Cyanide | | | |

## 9.0 INTERNAL QUALITY CONTROL

Internal quality control will be monitored during project scoping to ensure that the collected data are of adequate quantity and quality to meet the project goal. The following DQOs stages listed below have been identified and will be applied.

- Evaluation of available data to develop a conceptual model of the site.
- Identification of data necessary to meet the desired objectives.
- Identification of appropriate analytical methods for sample analyses.

Quality Control (QC) procedures will focus on sample collection, sample analysis, and identification of the needs to meet State of California, EPA, and Project QAPP requirements.

## 9.1 LABORATORY QUALITY CONTROL

The laboratory control samples will function as monitors of the performance of the analytical methods. When samples are analyzed, the QC procedures listed below may be incorporated into the chemical analysis program.

- Method blanks
- Laboratory control samples
- Surrogate spikes (GC/MS techniques only)
- Blind quality control samples (as-needed basis)
- Instrument calibration techniques and frequency
- Sample holding times
- Reagent quality control
- Maintenance of SOPs
- Sample preservation
- Personnel training and indoctrination
- Duplicate samples
- Laboratory control samples

Quality Control procedures will not be limited to the above areas of concern. All actions not required, but regarded as integral to Good Laboratory Practice (GPL), will be enforced and carried out at all times during all activities related to sample analyses.

## 10.0 PERFORMANCE AND SYSTEMS AUDITS

The NDQAO will arrange for the performance of laboratory and field audits during execution of the project as a QC check to examine general compliance of the field and laboratory personnel to approved guidelines. An audit will be performed at the beginning of the project to ascertain that all members fully understand the project objectives and their respective functions. Two follow-up audits will be conducted during actual execution of field and laboratory activities to ensure that personnel practices meet the set quality objectives, standard operating procedures, and QAPP requirements.

## 10.1 LABORATORY AUDIT

The subcontract laboratory QA Coordinator will perform internal laboratory audits as part of routine duties. These audits will include an evaluation of adherence in actual practice to the procedure outlined in the project plan and the QAPP. In particular, procedures concerned with preparation of standards, instrument analyses, documentation, quality control samples, and data management will be inspected. Deviation from approved procedures will be recorded, as well as the action necessary to correct the condition. All information will be provided to the QAO.

As an integral part of the NDQAO's responsibility, an external audit may be conducted to ensure that the subcontract laboratory is in compliance with the QAPP requirements. The audit approach will include but not be limited to:

- Sample tracking systems
- Standard preparations
- Analytical instrument operations
- Sample extraction and analyses procedures
- Documentation procedures
- Data review procedures

- Corrective action procedures
- Analyst knowledge of project objectives
- Laboratory audit check lists that are included in Appendix C

## 10.2 FIELD AUDIT

During the field sample collection, two unannounced audits will be conducted by the NDQAO or their representative to ensure conformance with QC procedures. These audits will focus on, but not be limited to, a review of the following:

- Sample identification procedures
- Field documentation methods
- Field chain-of-custody
- Observation of field analysis protocols and procedures
- Observation of sampling protocols and procedures
- Observation of equipment decontamination procedures

All audit findings and corrections will be documented and reported. Audit check lists are included in Appendix C.

## 10.3 AUDIT REPORTS

During and after any audit, the auditors will discuss their findings with the individuals audited and suggest necessary corrective actions. Any administrative findings which can be resolved to the satisfaction of the auditors in the course of the audit will not be noted on the audit checklist. Following completion of an audit, the auditors will prepare and submit an audit report to the

OUM with a copy sent to the NDPM, who, in turn, will provide the information to other organizations and NASA. The report shall include the following:

- Date(s) of the audit
- Identification of audit participants,
- Identification of activities audited
- Audit results
- Corrective action items
- Due date for corrective actions
- Means of audit response
- Audit checklist

If an audit by the NDQAO reveals that major or long-term corrective actions are needed, the responsible OUM will define and implement the necessary actions to correct the cause(s) of the problem and to remedy any immediate effects of the problem. In addition, several time-critical field events such as well installation and short-term activities such as equipment decontamination must receive immediate corrective action attention. In the event an audit confirms a non-compliance, all parties to the FFA will be notified for further actions.

## 11.0 PREVENTIVE MAINTENANCE

The objectives of a preventive maintenance program for field sampling and analytical equipment are to avoid generating spurious environmental measurements that could lead to inappropriate remedial responses, and to ensure timely and effective completion of an analytical measurement effort by minimizing the down time of crucial sampling or analytical equipment.

## 11.1 LABORATORY EQUIPMENT

The laboratories will periodically maintain and calibrate their major equipment, including gas chromatograph/mass spectrophotometer, gas chromatograph, high pressure liquid chromatograph, atomic absorption spectrophotometer, inductively coupled plasma spectrophotometer, etc. This maintenance requirement will also apply to all test and measurement equipment used in the laboratory. The laboratories will have the full responsibility of maintaining the equipment. The NDQAO, or their representative will verify that these control measures are established, implemented, and verifiable during audits.

## 11.2 FIELD EQUIPMENT

All field equipment (pH, conductivity meters, etc.) will be maintained according to manufacturer's instructions. Prior to sampling, each instrument will be tested and calibrated as per the instrument's manual and sampling technique requirements. Any equipment that fails to meet manufacturer and/or calibration requirements will not be used for sampling unless the problem is corrected by an authorized dealer.

## 12.0 DATA ASSESSMENT

Data generated for the RI/FS work will be assessed in various ways, including review against established quality criteria and use of statistical procedures to determine trends and outlines. The goal of the assessment is to determine the extent available information meets the set project goals. The elements of data assessment will include data-quality characteristics, usability, laboratory compliance, data validation, and representativeness of sample results to the general area of study.

Data-quality characteristics will address the issues in terms of precision, accuracy, detection limits, representativeness, and comparability to existing data. The information obtained will be used to provide reasonable assurance that the resulting data was generated by established and/or accepted procedures in such a manner as to be representative of the environmental condition and media examined. Additionally, the data will be reviewed for any trend in the concentration of a particular analyte/compound for a defined area, such as upgradient, downgradient, background, and study area. Statistical evaluation of data may be applied to determine variations and outlines that may reveal important information about the study area. The statistical parameters may include frequency and normal distributions, mean, standard deviations, range (maximum and minimum), null hypothesis, etc. For the purpose of assessment, sample results may be grouped by common hydrogeological conditions to assess change in concentration of analyte/compound detected. Similarly grouping may apply for groundwater samples collected at different time period. The application of statistical procedures will depend on the number of data points available for each contaminant detected. As part of the data assessment, data may be compared between previous and current sampling events to determine if any changes exist in the concentration of a contaminant, if detected.

For positive results, data will be evaluated against established baseline risks for potential impacts of contaminants to the environment and human health. This procedure applies contaminant

concentration, fate and transport calculations, and exposure pathways to provide an assessment of potential risk.

## 13.0 QUALITY ASSURANCE REPORT

Interaction between the field team members, the OUM, the NASA Designated Project Manager, the laboratories, and the project NDQAO is required to assure effective management of the sampling and analytical program. The NDPM and NDQAO will receive routine updates concerning sampling activities and laboratory results. The NDQAO or designee, will promptly review all laboratory analytical activities to ensure compliance with QA requirements.

When necessary, the NDQAO will prepare quality assurance reports for the NDPM on the performance of the QAPP. Any potential problems which arise will be communicated to the program management team immediately.

A summary report will be prepared by the NDQAO after final review of all of the field and analytical data reports. The report will address sampling and analysis problems, including deviation from QA/QC procedures, that will impact data quality.

# 14.0 NONCONFORMANCE AND CORRECTIVE ACTION PROCEDURES

Once a problem has been identified, the process (whether analytical or review) should be halted until the reason for the problem has been identified. Finding the source of a QC problem involves identifying probable sources of error, and checking each source to determine if the protocols were properly followed. Usually, the individual who is responsible for identifying the problem is responsible for determining the cause. However, other personnel and organizations may need to be involved.

## 14.1 INITIATING CORRECTIVE ACTION

When the source of a QC error has been identified, appropriate steps must be taken to eliminate or minimize recurrences. Corrective actions may be initiated by

- The individual who is operating the instrument or
- An individual in oversight authority if a solution is not immediately apparent.

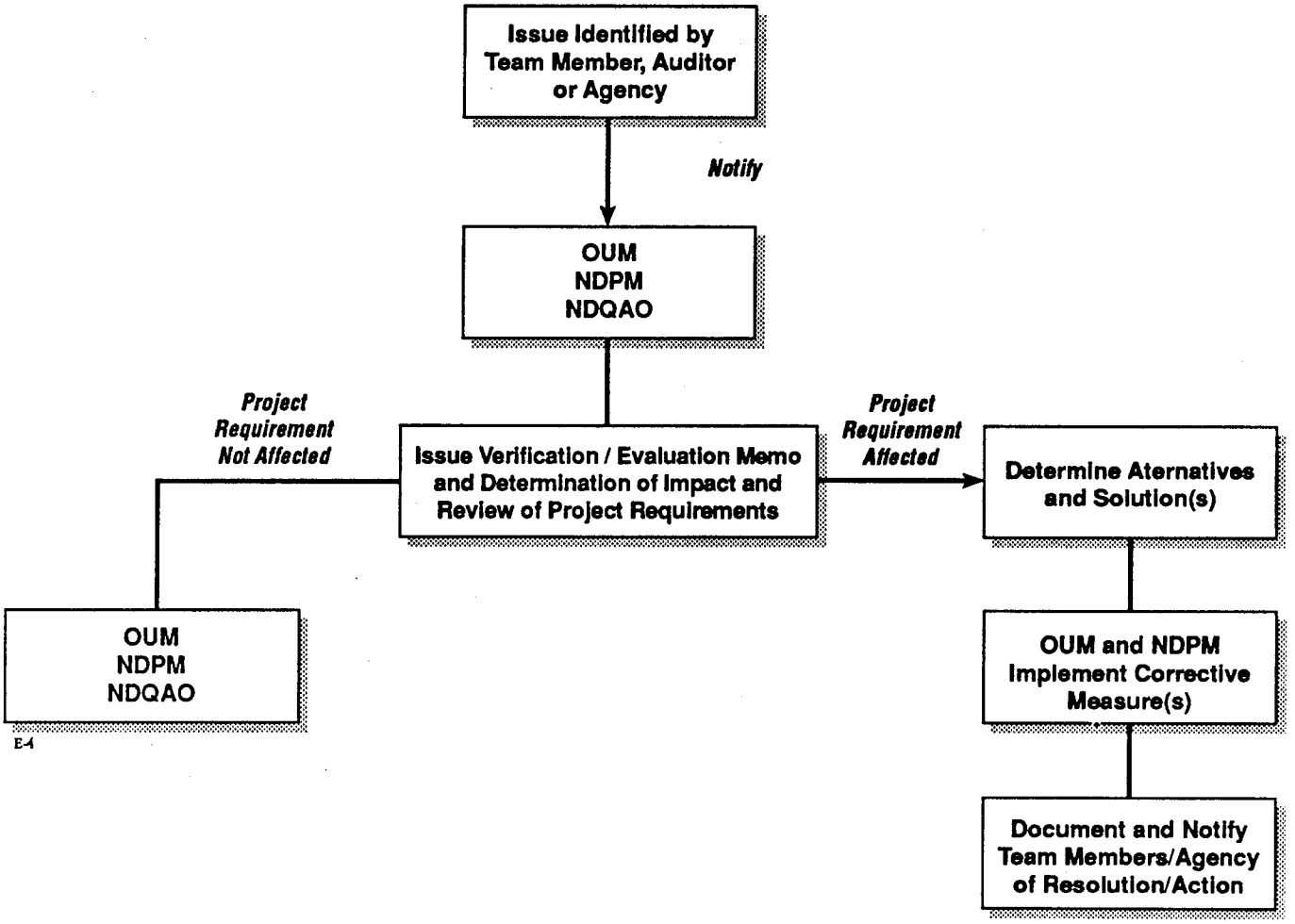
## 14.2 DOCUMENTATION AND NOTIFICATION OF AFFECTED PARTIES

If a quality-control measure fails to meet acceptance criteria, the QC measure and the procedures that were used to correct the problem **must be documented**. The documentation requirements for this QAPP are discussed in Section 15.0.

A decision tree describing nonconformance and corrective action procedures is provided in Figure 14-1.

# FIGURE 14-1

## NONCONFORMANCE AND CORRECTIVE ACTION PROCEDURES




E-4

# 15.0 DOCUMENTATION

The degree of rigor used in documenting sampling and analyses activities varies with the objectives of the project and the intended use of the data generated during the investigation. Validation, traceability, data and sample security, representativeness, and retrievability are of particular concern. All project information will be recorded and kept in the project file. As an integral part of quality assurance, the NDQAO will review documentation information to ensure compliance to QAPP requirements.

## 15.1 FIELD DOCUMENTATION

Observation and measurement made during the field investigation will be documented in a bound logbook of field data log forms, such as soil boring logs, well development/sampling logs, and chain-of-custody. For sample documentation, the information will include but is not limited to the following:

- Sample number
- Sample depth
- Collection method
- Date and time of collection
- Observation
- Summary of each day's activities
- Names of samplers and signatures

## 15.2 LABORATORY DOCUMENTATION

The laboratory will be responsible for documentation of sample handling and analyses activities. The lab will document this information in bound notebooks, chain-of-custody, and log forms when necessary. The information will include, but is not limited to the items listed below:

- Sample log-in
  - Date of receipt
  - Carrier from whom received
  - Number of shipping containers received
  - Site and sample identification
  - Condition of samples on arrival
  - Internal laboratory identification

- Sample and standard preparation
  - Date
  - Operation (extraction, distillation, digestion, etc.)
  - Weight and volume of sample used
  - Sample identification
  - Source of reagent or standard
  - Concentration of reagent or standard
  - Signature of analyst

- Instrument Analysis
  - Date
  - Instrument specific number
  - Analyte(s) of concern
  - Response and calibration of standards
  - External calibration check
  - Sample identification
  - Signature or analyst

- Instrument Maintenance
  - Date of activity
  - Nature of activity (repair, periodic maintenance, parts replacement, etc.)
  - Malfunctions observed
  - Signature of person performing the activity.

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4. Office of the Federal Register, National Archives and Records Administration. Code of Federal Regulations, Protection of Environment, Title 40, Parts 100 to 149.

5. U.S. Environmental Protection Agency, Robert S. Kerr Environmental Research Laboratory. Practical Guide for Groundwater Sampling. EPA/600/2-85/10. Ada, Oklahoma. September 1985.

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9. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Test Methods for Evaluating Solid Waste (First Update). EPA/SW-846. January 1988.

10. U.S. Environmental Protection Agency, Contract Laboratory Program. Statement of Work Organics Analysis, Multimedia, Multi-Concentration. October 1986.

11. U.S. Environmental Protection Agency, Contract Laboratory Program. Statement of Work for Inorganics Analysis, Multimedia, Multi-Concentration. SOW No. 787.

# APPENDIX A

# ANALYTICAL PARAMETERS, DETECTION LIMITS, PRELIMINARY REMEDIATION GOALS AND SOIL VAPOR SOP

## REQUIRED DETECTION LIMITS FOR *VOLATILE ORGANICS*
## METHOD: SW846 8240
## JANUARY 1988

| Compound | Required Detection Limit | Preliminary Remediation Goal[1] |
|---|---|---|
| | Soil ($\mu$g/kg) | Industrial Soil ($\mu$g/kg) |
| Chloromethane | 10 | 6.2E+03 |
| Bromomethane | 10 | 8.4E+03 |
| Vinyl Chloride | 10 | 1.6E+01 |
| Chloroethane | 10 | [10] |
| Methylene Chloride | 5 | 3.9E+04 |
| Acetone | 100 | 1.3E+07 |
| Carbon Disulfide | 5 | 7.4E+04 |
| 1,1-Dichloroethene | 5 | 1.2E+02 |
| 1,1-Dichloroethane | 5 | 4.0E+05 |
| trans-1,2-Dichloroethene | 5 | 8.7E+05 |
| Chloroform | 5 | 1.6E+03 |
| 1,2-Dichloroethane | 5 | 1.4E+03 |
| 2-Butanone (methyl ehtyl Ketone) | 100 | 5.2E+06 |
| 1,1,1-Trichloroethane | 5 | 3.0E+05 |
| Carbon Tetrachloride | 5 | 1.6E+03 |
| Vinyl Acetate | 50 | 1.0E+08 |
| Bromodichloromethane | 5 | 5.1E+03 |
| 1,2-Dichloropropane | 5 | 2.3E+03 |
| cis-1,3-Dichloropropene | 5 | 1.8E+03 |
| Trichloroethene | 5 | 2.5E+04 |
| Dibromochloromethane | 5 | 1.0E+08 |
| 1,1,2-Trichloroethane | 5 | 5.1E+03 |
| Benzene | 5 | 4.6E+03 |
| trans-1,3-Dichloropropene | 5 | 1.8E+03 |
| Bromoform | 5 | 2.5E+04 |
| 4-Methyl-2-Pentanone (methyl isobutyl ketone) | 50 | 5.1E+07 |
| 2-Hexanone (methyl butyl ketone) | 50 | [50] |
| Tetrachloroethene | 5 | 5.8E+04 |
| Toluene | 5 | 2.8E+05 |
| 1,1,2,2-Tetrachloroethane | 5 | 4.0E+03 |
| Chlorobenzene | 5 | 3.0E+05 |
| Ethyl Benzene | 5 | 3.1E+05 |
| Styrene | 5 | 1.3E+07 |
| Xylenes (Total) | 5 | 9.9E+04 |
| 2-Chloroethyl Vinyl Ether | 10 | [10] |

Notes: Method detection limits are highly matrix-dependent and may vary slightly.
Method detection limits for soil are based on wet weight.

1: Preliminary Remediation Goals are non-site specific EPA health-protective exposure assumptions based on EPA default values used to estimate "safe" contaminant levels in environmental media.

[ ] = Preliminary Remediation Goal not available for this analyte or below the analytical detection limit pursuant to US EPA SW 846 procedures. The Required Detection Limit has been listed.

# REQUIRED DETECTION LIMITS FOR *SEMIVOLATILE ORGANICS*
# METHOD: SW846 8270
# JANUARY 1988

| Compound | Required Detection Limit | | Preliminary Remediation Goal[1] | |
|---|---|---|---|---|
| | Water (µg/l) | Soil (µg/kg) | Water (µg/l) | Soil (µg/kg) |
| Phenol | 10 | 660 | [10] | [660] |
| bis(2-chloroethyl)ether | 10 | 660 | [10] | [660] |
| 2-Chlorophenol | 10 | 660 | 1.8E+02 | 5.1E+06 |
| 1,3-Dichlorobenzene | 10 | 660 | [10] | 2.8E+05 |
| 1,4-Dichlorobenzene | 10 | 660 | [10] | 3.2E+04 |
| Benzyl Alcohol | 10 | 1300 | 1.1E+04 | 1.0E+08 |
| 1,2-Dichlorobenzene | 10 | 660 | 4.8E+02 | 2.3E+05 |
| 2-Methylphenol | 10 | 660 | 1.8E+03 | 5.1E+07 |
| bis(2-chloroisopropyl)ether | 10 | 660 | [10] | 2.3E+04 |
| 4-Methylphenol | 10 | 660 | 1.8E+02 | 5.1E+07 |
| N-nitroso-di-n-dipropylamine | 10 | 660 | [10] | [660] |
| Hexachloroethane | 10 | 660 | [10] | 2.0E+05 |
| Nitrobenzene | 10 | 660 | 1.8E+01 | 5.1E+05 |
| Isophorone | 10 | 660 | 9.0E+01 | 3.0E+07 |
| 2-Nitrophenol | 10 | 660 | [10] | [660] |
| 2,4-Dimethylphenol | 10 | 660 | 7.3E+02 | 2.0E+07 |
| Benzoic Acid | 50 | 3300 | 1.5E+05 | 1.0E+08 |
| bis(2-chloroethoxy)methane | 10 | 660 | [10] | [660] |
| 2,4-Dichlorophenol | 10 | 660 | 1.1E+02 | 3.1E+06 |
| 1,2,4-Trichlorobenzene | 10 | 660 | 2.3E+01 | 5.5E+05 |
| Naphthalene | 10 | 660 | [10] | [660] |
| 4-Chloroaniline | 10 | 1300 | 1.5E+02 | 4.1E+06 |
| Hexachlorobutadiene | 10 | 660 | [10] | 3.7E+04 |
| 4-Chloro-3-methylphenol | 10 | 1300 | [10] | [1300] |
| 2-Methylnaphthalene | 10 | 660 | [10] | [660] |
| Hexachlorocyclopentadiene | 10 | 660 | [10] | [660] |
| 2,4,6-Trichlorophenol | 10 | 660 | [10] | 2.6E+05 |
| 2,4,5-Trichlorophenol | 50 | 660 | 3.7E+03 | 9.3E+02 |
| 2-Chloronaphthalene | 10 | 660 | 2.9E+03 | 8.2E+07 |
| 2-Nitroaniline | 50 | 3300 | [50] | 6.1E+04 |
| Dimethylphthalate | 10 | 660 | 3.7E+05 | 1.0E+08 |
| Acenaphthylene | 10 | 660 | [10] | [660] |
| 2,6-Dinitrotoluene | 10 | 660 | [10] | 4.2E+03 |
| 3-Nitroaniline | 50 | 3300 | [50] | [3300] |
| Acenaphthene | 10 | 660 | [10] | [660] |
| 2,4-Dinitrophenol | 50 | 3300 | 7.3E+01 | 2.0E+06 |
| 4-Nitrophenol | 50 | 3300 | [50] | [3300] |
| Dibenzofuran | 10 | 660 | [10] | [660] |

## REQUIRED DETECTION LIMITS FOR *SEMIVOLATILE ORGANICS*
## METHOD: SW846 8270 (Continued)
## JANUARY 1988

| Compound | Required Detection Limit | | Preliminary Remediation Goal[1] | |
|---|---|---|---|---|
| | Water (µg/l) | Soil (µg/kg) | Water (µg/l) | Soil (µg/kg) |
| 2,4-Dinitrotoluene | 10 | 660 | 7.3E01 | 2.0E+06 |
| Diethylphthalate | 10 | 660 | 2.9E+04 | 1.0E+08 |
| 4-Chlorophenyl-phenyl ether | 10 | 660 | [10] | [660] |
| Fluorene | 10 | 660 | [10] | [660] |
| 4-Nitroaniline | 50 | 3300 | [50] | [3300] |
| 4,6-Dinitro-2-methylphenol | 50 | 3300 | [50] | [3300] |
| N-nitrosodiphenylamine | 10 | 660 | [10] | [660] |
| 4-Bromophenyl-phenylether | 10 | 660 | [10] | [660] |
| Hexachlorobenzene | 10 | 660 | [10] | 1.8E+03 |
| Pentachlorophenol | 50 | 3300 | [50] | 2.4E+04 |
| Phenanthrene | 10 | 660 | [10] | [660] |
| Anthracene | 10 | 660 | [10] | [660] |
| Di-n-butylphthalate | 10 | 660 | 3.7E+06 | 1.0E+08 |
| Fluoranthene | 10 | 660 | [10] | [660] |
| Pyrene | 10 | 660 | 1.1E+06 | 3.1E+07 |
| Butylbenzylphthalate | 10 | 660 | 7.3E+06 | 1.0E+08 |
| 3,3'-Dichlorobenzidine | 20 | 1300 | 1.9E+02 | 6.4E+03 |
| Benzo(a)anthracene | 10 | 660 | [10] | [660] |
| Chrysene | 10 | 660 | [10] | [660] |
| bis(2-ethylhexyl)phthalate | 10 | 660 | 6.1E+03 | 2.0E+05 |
| Di-n-octylphthalate | 10 | 660 | 7.3E+05 | 2.0E+07 |
| Benzo(b)fluoranthene | 10 | 660 | [10] | [660] |
| Benzo(k)fluoranthene | 10 | 660 | [10] | [660] |
| Benzo(a)pyrene | 10 | 660 | [10] | [660] |
| Indeno(1,2,3-cd)pyrene | 10 | 660 | [10] | [660] |
| Dibenzo(a,h)anthracene | 10 | 660 | [10] | [660] |
| Benzo(g,h,i)perylene | 10 | 660 | [10] | [660] |

Notes: Method detection limits are highly matrix-dependent and may vary slightly. The detection limits listed herein are provided for guidance.

Method detection limits listed for soil are based on wet weight.

1: Preliminary Remediation Goals are non-site specific EPA health-protective exposure assumptions based on EPA default values used to estimate "safe" contaminant levels in environmental media.

[ ] = Preliminary Remediation Goal not available for this analyte or below the analytical detection limit pursuant to US EPA SW 846 procedures. The Required Dectection Limit has been listed.

## REQUIRED METHOD DETECTION LIMITS FOR *INORGANICS*

## EPA SOW JULY 1991

| Compound | Required Detection Limit | | Preliminary Remediation Goal[1] | |
|---|---|---|---|---|
| | Water (µg/l) | Soil (mg/kg) | Water (µg/l) | Soil (mg/kg) |
| Strontium | 10 | 10 | 2.2E+04 | 1.0E+05 |
| Aluminum | 10 | 10 | 3.7E+04 | 1.0E+08 |
| Antimony | 6 | 6 | 1.5E+01 | 8.2E+05 |
| Arsenic | 5 | 5 | [5] | 3.3E+03 |
| Barium | 50 | 50 | 2.6E+03 | 1.0E+05 |
| Beryllium | 4 | 4 | [4] | 1.3E+03 |
| Cadmium | 5 | 5 | 1.8E+01 | 4.9E+05 |
| Calcium | 1000 | 5000 | [1000] | [5000] |
| Chromium | 10 | 10 | [10] | 1.6E+06 |
| Chromium ($Cr^{+6}$) | 5 | 1 | [5] | [1] |
| Cobalt | 50 | 50 | [50] | [50] |
| Copper | 10 | 25 | 1.4E+03 | 7.6E+04 |
| Iron | 100 | 100 | [100] | [100] |
| Lead | 2 | 3 | 4.0E+00 | [3] |
| Magnesium | 1000 | 5000 | [1000] | [5000] |
| Manganese | 15 | 15 | 1.8E+02 | 1.0E+07 |
| Mercury | 2 | 2 | 1.1E+01 | 6.1E+02 |
| Nickel | 40 | 40 | 7.3E+02 | 4.1E+07 |
| Potassium | 1000 | 5000 | [1000] | [5000] |
| Selenium | 5 | 5 | 1.8E+02 | 1.0E+07 |
| Silver | 10 | 10 | 1.8E+02 | 1.0E+07 |
| Sodium | 1000 | 1000 | [1000] | [1000] |
| Thallium | 2 | 10 | [2] | [10] |
| Vanadium | 50 | 50 | 2.6E+02 | 1.4E+07 |
| Zinc | 20 | 20 | 1.1E+04 | 1.0E+08 |
| Cyanide | 5 | 10 | [5] | [10] |

Notes: Method detection limits are highly matrix-dependent and may vary slightly. Detection limits listed for soil are based on wet weight.

1: Preliminary Remediation Goals are non-site specific EPA health-protective exposure assumptions based on EPA default values used to estimate "safe" contaminant levels in environmental media.

[ ] = Preliminary Remediation Goal not available for this analyte or below the analytical detection limit pursuant to US EPA SW 846 procedures. The Required Detection Limit has been listed.

## REQUIRED DETECTION LIMITS FOR *SOIL GAS ANALYSES BY GAS CHROMATOGRAPHY*
## STATE OF CALIFORNIA
## OCTOBER 1992

| Compound | Required Method Detection Limit ($\mu$g/l) |
|---|---|
| Carbon Tetrachloride | 0.1- 1.0 |
| Chlorobenzene | 0.1- 1.0 |
| Chlorethane | 0.1- 1.0 |
| Dibromochloromethane | 0.1- 1.0 |
| 1,1-Dichloroethane | 0.1- 1.0 |
| 1,2-Dichloroethane | 0.1- 1.0 |
| 1,1-Dichloroethene | 0.1- 1.0 |
| cis- and trans-1,2-Dichloroethene | 0.1- 1.0 |
| Dichloromethane | 0.1- 1.0 |
| 1,1,2,2-Tetrachloroethane | 0.1- 1.0 |
| 1,1,1,2-Tetrachloroethane | 0.1- 1.0 |
| Tetrachloroethene | 0.1- 1.0 |
| 1,1,1-Trichloroethane | 0.1- 1.0 |
| 1,1,2-Trichloroethane | 0.1- 1.0 |
| Tetrachloroethane | 0.1- 1.0 |
| Trichlorofluoromethane | 0.1- 1.0 |
| Vinyl Chloride | 0.1- 1.0 |
| Benzene | 0.1- 1.0 |
| Ethylbenzene | 0.1- 1.0 |
| Toluene | 0.1- 1.0 |
| Xylenes | 0.1- 1.0 |

Notes: Method detection limits are highly matrix-dependent and may vary slightly.

## REQUIRED DETECTION LIMITS FOR *VOLATILE ORGANICS*
## METHOD: 524.2
## DRINKING WATER ACT
## 40 CFR 1991

| Compound | Required Detection Limit (µg/l) | Preliminary Remediation Goal[1] Water (µg/l) |
|---|---|---|
| Benzene | 0.5 | 6.2E-01 |
| Vinyl chloride | 0.5 | [0.5] |
| Carbon tetrachloride | 0.5 | [0.5] |
| 1,2-Dichloroethane | 0.5 | [0.5] |
| Trichloroethylene | 0.5 | 2.5E+00 |
| 1,4-Dichlorobenzene | 0.5 | 7.5E-01 |
| 1,1-Dichloroethylene | 0.5 | [0.5] |
| 1,1,1-Trichloroethane | 0.5 | 1.5E+03 |
| Bromobenzene | 0.5 | [0.5] |
| Bromodichloromethane | 0.5 | [0.5] |
| Bromoform | 0.5 | 1.1E+01 |
| Bromomethane | 0.5 | 1.1E+01 |
| Chlorobenzene | 0.5 | 5.2E+01 |
| Chlorodibromomethane | 0.5 | [0.5] |
| Chloroethane | 0.5 | [0.5] |
| Chloroform | 0.5 | [0.5] |
| Chloromethane | 0.5 | 2.3E+00 |
| o-Chlorotoluene | 0.5 | 1.5E+02 |
| p-Chlorotoluene | 0.5 | [0.5] |
| Dibromomethane | 0.5 | [0.5] |
| 1,3-Dichlorobenzene | 0.5 | [0.5] |
| 1,2-Dichlorobenzene | 0.5 | 4.8E+02 |
| trans-1,2-Dichloroethylene | 0.5 | 1.5E+02 |
| cis-1,2-Dichloroethylene | 0.5 | 7.7E+01 |
| Dichloromethane | 0.5 | [0.5] |
| 1,1-Dichloroethane | 0.5 | 1.0E+03 |
| 1,1-Dichloropropene | 0.5 | [0.5] |
| 1,2-Dichloropropane | 0.5 | [0.5] |
| 1,3-Dichloropropane | 0.5 | [0.5] |
| cis-1,3-Dichloropropene | 0.2 | [0.2] |
| trans-1,3-Dichloropropene | 0.5 | [0.5] |
| 2,2-Dichloropropane | 0.5 | [0.5] |

## REQUIRED DETECTION LIMITS FOR *VOLATILE ORGANICS*
## METHOD: 524.2 (Continued)
## DRINKING WATER ACT
## 40 CFR 1991

| Compound | Required Detection Limit (µg/l) | Preliminary Remediation Goal[1] Water (µg/l) |
|---|---|---|
| Ethyl benzene | 0.5 | 1.6E+03 |
| Styrene | 0.5 | 1.5E+03 |
| 1,1,2-Trichloroethane | 0.5 | [0.5] |
| 1,1,1,2-Tetrachloroethane | 0.5 | 6.9E-01 |
| 1,1,2,2-Tetrachloroethane | 0.5 | [0.5] |
| Tetrachloroethylene | 0.5 | 1.4E+00 |
| 1,2,3-Trichloropropane | 0.5 | 4.0E+01 |
| Toluene | 0.5 | 9.3E+02 |
| m,p-Xylenes | 0.5 | 1.9E+03 |
| o-Xylene | 0.5 | [0.5] |
| Bromochloromethane | 0.5 | [0.5] |
| n-Butylbenzene | 0.5 | [0.5] |
| Dichlorodifluoromethane | 0.5 | 5.2E+02 |
| Fluorotrichloromethane | 0.5 | 1.7E+03 |
| Hexachlorobutadiene | 0.5 | 1.1E+00 |
| Isopropylbenzene | 0.5 | [0.5] |
| p-Isopropyltoluene | 0.5 | [0.5] |
| Naphthalene | 0.5 | [0.5] |
| n-Propylbenzene | 0.5 | [0.5] |
| sec-Butylbenzene | 0.5 | [0.5] |
| tert-Butylbenzene | 0.5 | [0.5] |
| 1,2,3-Trichlorobenzene | 0.5 | [0.5] |
| 1,2,4-Trichlorobenzene | 0.5 | 2.3E+01 |
| 1,2,4-Trimethylbenzene | 0.5 | [0.5] |
| 1,3,5-Trimethylbenzene | 0.5 | [0.5] |
| 2-Butanone (MEK) | 5.0 | 2.5E+03 |
| 4-Methyl-2-Pentanone | 5.0 | 1.8E+03 |
| Trichlorotrifluoroethane | 0.5 | 7.8E+04 |

Note: Method detection limits are highly matrix-dependent and may vary slightly.

1: Preliminary Remediation Goals are non-site specific EPA health-protective exposure assumptions based on EPA default values used to estimate "safe" contaminant levels in environmental media.

[ ] = Preliminary Remediation Goal not available for this analyte or below the analytical detection limit pursuant to US EPA SW 846 procedures. The Required Dection Limit has been listed.

## REQUIRED DETECTION LIMITS FOR *GENERAL CHEMISTRY*

## SW-846 1988

| Compound | Analytical Method | Required Detection Limit ($\mu$g/l) | Preliminary Remediation Goal[1] ($\mu$g/l) |
|---|---|---|---|
| Chloride | EPA 300 | 1000 | [1000] |
| Fluoride | EPA 300 | 100 | 2.2E+03 |
| Sulfate | EPA 300 | 2000 | [2000] |
| Nitrate | EPA 300 | 100 | 5.8E+04 |
| Phosphate | EPA 300 | 50 | [50] |
| Total Dissolved Solids | 160.1 | 10,000 | NA |
| pH | 150.1 (field) | 0.01 units | NA |
| Specific Conductance | 120.1 (field) | 4 $\mu$mhos/cm | NA |
| Alkalinity | EPA 310.1 | 2,000 | NA |

Notes:

NA = Not Available

1: Preliminary Remediation Goals are non-site specific EPA health-protective exposure assumptions based on EPA default values used to estimate "safe" contaminant levels in environmental media.

[ ]: Preliminary Remediation Goal not available for this analyte or below the analytical detection limit pursuant to US EPA SW 846 procedures. The Required Detection Limit has been listed.

STATE OF CALIFORNIA
California Regional Water Quality Control Board - Los Angeles Region

WORK PLAN REQUIREMENTS FOR ACTIVE SOIL GAS INVESTIGATION
WELL INVESTIGATION PROGRAM (WIP)

The objectives of these investigations are to: 1) evaluate potential waste discharges which may impact ground water, 2) determine variation and extent of soil contaminants, 3) establish vapor distribution for the design of vapor extraction system (VES), and 4) aid in determining the potential efficiency and appropriate design for any cleanup action, including VES. The work plan should include, but not be limited to, the following:

Survey Design (location, number, depth, data quality objectives)

1. Provide a scaled facility plot plan depicting potential source areas and proposed soil gas sample points. Include location and coordinate of identifiable geographic landmarks (i.e., street center-line, benchmark, street intersection or wells).

2. Locate soil gas sample points using 20-30 foot grid in potential source areas and no more than 100 foot grid for the rest of the site (coarse survey). Provide rationale for the number, location, and depth of sample points.

3. Conduct close interval (10'-20' foot grid) multi-depth sampling (3 to 5 feet between points) in areas with known soil contaminants and where prior soil gas sampling has detected relatively high levels of VOCs at the site.

4. Real time analysis of samples allows for field modification of the sampling plan (for grid density, location, and depth) based upon test results. However, field adjustments are acceptable only if the decision-making criteria are included in the approved work plan and in consultation with Board staff.

5. If anomalous data (i.e., soil gas values 2 to 3 orders of magnitude different from trends indicated by surrounding samples) are obtained from a sample point, resample and reanalyze at that point.

Sample Collection

1. Obtain samples at an adequate depth (minimally 5 feet) below the ground surface to minimize atmospheric air interference.

2. Discuss techniques to determine optimal purge rates and volumes. Minimum purging (3 probe volumes maximum) is required so that the samples are representative of VOC levels in the formation around the probe tip. At the beginning of the survey, conduct a site-specific purge volume versus contaminant concentration

test where VOC levels are expected to be highest, for major lithologic units or when significant pressure change is encountered to ensure that samples are representative of site conditions. Adjust purge rate and time to achieve optimal purge volume.

3. Explain the zone of influence for soil gas sample points, taking into consideration soil types, land cover, drive point construction, and sample purge time/rate/volume. The vertical zone of influence from soil gas purging and sampling must not intersect the ground surface.

4. Discuss procedures to minimize cross contamination between sample points.

5. Detail soil gas sample collection, handling, and testing procedures. Record the atmospheric pressure and evacuation pressure at which the sample is collected and the sample volume. Discuss procedures to prevent collection of samples under vacuum.

6. Select and specify soil gas sampling equipment (e.g., gas tight syringe) that will not affect sample integrity.

Sample Analysis

1. An on-site mobile laboratory with laboratory-grade certifiable instrumentation and procedures is required for real time analyses of individual VOCs. Non-specific portable organic vapor analyzers and/or GC-based handheld detectors may not be used for sample analysis.

2. Specify target compounds analysis list. Detection limits of 0.01 to 1.0 µg/l (soil gas) must be attained. Justify the use of higher detection limits.

3. Specify and justify time between sample collection and analysis.

4. Specify column characteristics, initial and final column temperatures, rate of column temperature increase per minute, calibration materials (liquid vs. gas sample) and sample flow rate employed in order to determine problems that may be associated with coeluting compounds. The chromatograms for calibration standards shall be included in the final report and provided to staff in the field for review to ensure that target compounds can be identified.

5. Provide QA/QC procedures essential for establishing support of analytical data. Include, at a minimum, field blanks, equipment blanks, initial and continuing calibration checks, laboratory

control standards, and sample replicates. Sampling equipment blank should be sampled from a contaminant-free source, if ambient air is not contaminant free.

Data Interpretation/Report of Findings

1. Methods to be used for data interpolation (contouring) must be detailed. At a minimum, where justified by the data, isoconcentration plots for each chlorinated volatile organic and aromatic hydrocarbon compound detected, and for total chlorinated volatile organics and for total aromatic hydrocarbons for each sampling depth must be presented in the final report. Provide cross-sections depicting the geology and changes in contaminant concentration with depth.

2. Data collected during field sampling and laboratory analyses must be compiled in tabular format and results are to be reported as mass/volume (i.e., µg/l).

3. Report all chromatographic peaks detected during the analyses run and any tentatively identified compounds.

Companion Soil Sampling

1. Conduct the soil sampling and VOC analyses per this Board's WIP WORK PLAN REQUIREMENTS for INITIAL SUBSURFACE INVESTIGATIONS.

2. Borehole locations and sampling intervals shall be based on soil gas survey results. Obtain discrete, undisturbed companion soil samples. Use a minimum 2-inch diameter sample tube.

3. Board staff must be part of the data review to determine companion soil sample locations and the need for additional soil/soil gas sampling.

**Soil Gas Guidelines for Data Package - Initial Demonstration of Laboratory Capability**

1. The data package should consist of a concise tabular summary the key elements necessary to demonstrate method proficiency.

2. Incomplete or disorganized packages are subject to delay or rejection of review.

3. All raw data including chromatograms and instrument printouts that support Data Package results should also be included. They should be properly identified for easy review. Every compound in the chromatograms should be clearly identified.

4. Summary of standards preparation for calibrations, preparation of laboratory control check samples should be included. If they are purchased, sources of the standards should be included.

5. List the operating conditions and instrumentation for each type of analyses.

6. Summary of calibration methods and determination of detection limits should be included. If one calibration standard is used for daily calibration, include results of the daily response factor and percent differences from the average RF of the calibration curve.

7. Calibrations and determination of detection limits should be done for each and every compound listed in EPA Methods 8010 and 8020. For detection limits, a sample with a concentration at detection limit should be prepared and checked for recovery. The recovery should be at least 50%.

8. For initial calibration, at least a three point calibration should be done. One point should be at the detection limit.

9. A copy of your laboratory Standard Operating Procedures (SOP) should be included. SOP should include but not limit to the following procedures.
   (a) Daily calibration method
   (b) Blank analysis
   (c) Laboratory quality control check sample analysis and frequency of this analysis during each day. For each day the last analysis should be done on QC check sample.
   (d) Procedures to handle when the sample concentration is outside the calibration linear range.
   (e) Confirmation of compounds detected
   (f) Duplicate analysis of samples
   (g) The holding time of the samples
   (h) Sample identification
   (i) QA/QC corrective actions
   (j) Report generation

**List of Twenty Two (22) Primary Target Compounds**
**(Chlorinated Volatile Organics and Aromatic Hydrocarbons)**

1. Carbon Tetrachloride
2. Chlorobenzene
3. Chloroethane
4. Dibromochloromethane
5. Dichlorodifluoromethane
6. 1,1-Dichloroethane
7. 1,2-Dichloroethane
8. 1,1-Dichloroethene
9. cis- and trans-1,2-Dichloroethene
10. Dichloromethane
11. 1,1,2,2-Tetrachloroethane
12. 1,1,1,2-Tetrachloroethane
13. Tetrachloroethene
14. 1,1,1-Trichloroethane
15. 1,1,2-Trichloroethane
16. Trichloroethene
17. Trichlorofluoromethane
18. Vinyl Chloride
19. Benzene
20. Ethylbenzene
21. Toluene
22. Xylenes

## QA/QC AND REPORTING REQUIREMENTS FOR SOIL GAS INVESTIGATION

### Initial Calibration

Initial calibration must be performed for all compounds in the 8010/8020 list. A minimum of 3 concentrations is required, while the lowest one must not be higher than three times the Method Detection Limit (0.1-1 μg/L). Identification and quantitation of environmental compounds must be based on calibration under the same analytical conditions (i.e. column, detector, and temperature program etc.). Change in any of these conditions or calibration standard stock solution must result in a new initial calibration.

### Daily Calibration and QA/QC

These must be performed and results calculated to demonstrate satisfactory running condition of the GC before any environmental sample can be analyzed.

1. 1-Point (Mid-Point) Calibration

   A minimum of 9 calibration standards, including 3 aromatics and 6 halogenated compounds representing short, medium and long retention time groups, must be checked at the beginning of a working day. One-point calibration check is required for all compounds detected at a particular site to ensure quantification, i.e. additional runs may be necessary if compounds other than the 9 calibration standards are found. Therefore it is recommendable to include commonly found volatile compounds in the initial 1-point calibration check. The response factor for each of the compounds must be within 15% of the corresponding value from the 3-point calibration, otherwise the GC must be re-calibrated.

2. Blanks

   Sampling equipment blank, ambient air sample, method blank and other appropriate blanks must be analyzed at least once at the beginning of the working day and as frequent as necessary during the rest of the day.

3. Quality Control (QC) Check Sample

   A minimum of two QC check samples (obtained from a source different from the calibration standards) must be analyzed each working day, one at the beginning and one at the end, i.e. bracketing the analysis of environmental samples. A minimum of 9 compounds as described earlier must be checked. Response for each compound must be within 20% of the corresponding true value. If the beginning QC check sample fails the requirement, the problem must be resolved before proceeding with sample analysis. If the end or any of the following QC check sample fails the requirement, then all environmental samples analyzed between the failed sample and the last acceptable QC check sample will be considered

questionable. Therefore it is recommendable to run QC check samples every 10 samples to ensure acceptable analysis.

Shortening the GC Run Time

Shortening the GC run time is acceptable only if it does not hamper identification and quantification of any compounds present at the subject site. A normal run must be performed whenever peaks are detected within retention time windows where co-elution is likely as indicated by the calibration chromatograms.

Compound Confirmation

Every compound detected at a site must be confirmed by a second column or mass spectroscopy identification. Usually one sample is adequate, and quantification is not required for the confirmation run.

Evaluation Check Sample

Soil gas investigations will be randomly selected for unannounced performance evaluation by requiring on-site analysis of check samples provided by this office.

Reporting of Sample Results and QA/QC Information

1. The date and time of injection, and analytical conditions must be provided for all environmental and QA/QC samples.

2. All concentrations must be reported in μg/L.

3. For (the most recent) initial calibration, the retention time and average response factor (RF) for each compound must be reported.

4. For daily 1-point calibration, the RF and percent difference from initial RF for each compound must be tabulated and reported.

5. For QC check samples, the true concentration, detected concentration, and percentage difference for each compound must be tabulated and reported.

6. For environmental samples, including any duplicates, the sample identification, sampling depth, purge volume, vacuum pressure, sampling time, injection time, injection volume, results, and any other sampling or analytical remarks, must be reported in a tabulated format. Unidentified or tentatively identified peaks must also be listed.

7. Chromatograms for calibration standards, QC check samples, and selected samples (e.g. samples with most compounds, highest concentrations, infrequent compounds, and representative samples for different source areas) must be submitted upon request.

8. Sample report forms containing all required sampling, analytical and QA/QC information are attached for references.

# SOIL GAS INITIAL CALIBRATION STANDARD REPORT

DATE: _____ ANALYST: _____ STD SOURCE: _____ MACHINE ID: _____

| COMPOUND | DETECTOR | 1st CONC _____ | | | | 2nd CONC _____ | | | | 3rd CONC _____ | | | | $RF_{ave}$ | SD | %RSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RT | MASS | AREA | RF | RT | MASS | AREA | RF | RT | MASS | AREA | RF | | | |
| Bromobenzene | | | | | | | | | | | | | | | | |
| Bromodichloromethane | | | | | | | | | | | | | | | | |
| Bromoform | | | | | | | | | | | | | | | | |
| Bromomethane | | | | | | | | | | | | | | | | |
| Carbon tetrachloride | | | | | | | | | | | | | | | | |
| Chloroethane | | | | | | | | | | | | | | | | |
| Chloroform | | | | | | | | | | | | | | | | |
| Chloromethane | | | | | | | | | | | | | | | | |
| Dibromochloromethane | | | | | | | | | | | | | | | | |
| Dibromomethane | | | | | | | | | | | | | | | | |
| Dichloromethane | | | | | | | | | | | | | | | | |
| 1,1-Dichloroethane | | | | | | | | | | | | | | | | |
| 1,2-Dichloroethane | | | | | | | | | | | | | | | | |
| 1,1-Dichloroethene | | | | | | | | | | | | | | | | |
| c-1,2-Dichloroethene | | | | | | | | | | | | | | | | |
| t-1,2-Dichloroethene | | | | | | | | | | | | | | | | |
| 1,2-Dichloropropane | | | | | | | | | | | | | | | | |
| c-1,3-Dichloropropene | | | | | | | | | | | | | | | | |
| t-1,3-Dichloropropene | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | | | | | | | | | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | | | | | | | | | | | | | | | | |
| Tetrachloroethene | | | | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | | | | | | | | | | | | | | | | |
| 1,1,2-Trichloroethane | | | | | | | | | | | | | | | | |
| Trichloroethene | | | | | | | | | | | | | | | | |
| 1,2,3-Trichloropropane | | | | | | | | | | | | | | | | |
| Trichlorofluoromethane | | | | | | | | | | | | | | | | |
| Vinyl chloride | | | | | | | | | | | | | | | | |
| Benzene | | | | | | | | | | | | | | | | |
| Chlorobenzene | | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | | | | | | | | | | | | | | | | |
| 1,3-Dichlorobenzene | | | | | | | | | | | | | | | | |
| 1,4-Dichlorobenzene | | | | | | | | | | | | | | | | |
| Ethyl benzene | | | | | | | | | | | | | | | | |
| Toluene | | | | | | | | | | | | | | | | |
| m,p-Xylenes | | | | | | | | | | | | | | | | |
| o-Xylene | | | | | | | | | | | | | | | | |

# SOIL GAS DAILY CALIBRATION STANDARD REPORT

DATE: _____ _____

SUPPLY SOURCE: _____ _____

MACHINE ID: _____ _____

| COMPOUND | MASS | RT | RF | %DIFF* | MASS | RT | RF | %DIFF* |
|---|---|---|---|---|---|---|---|---|
| Bromobenzene | | | | | | | | |
| Bromodichloromethane | | | | | | | | |
| Bromoform | | | | | | | | |
| Bromomethane | | | | | | | | |
| Carbon tetrachloride | | | | | | | | |
| Chloroethane | | | | | | | | |
| Chloroform | | | | | | | | |
| Chloromethane | | | | | | | | |
| Dibromochloromethane | | | | | | | | |
| Dibromomethane | | | | | | | | |
| Dichloromethane | | | | | | | | |
| 1,1-Dichloroethane | | | | | | | | |
| 1,2-Dichloroethane | | | | | | | | |
| 1,1-Dichloroethene | | | | | | | | |
| c-1,2-Dichloroethene | | | | | | | | |
| t-1,2-Dichloroethene | | | | | | | | |
| 1,2-Dichloropropane | | | | | | | | |
| c-1,3-Dichloropropene | | | | | | | | |
| t-1,3-Dichloropropene | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | | | | | | | | |
| Tetrachloroethene | | | | | | | | |
| 1,1,1-Trichloroethane | | | | | | | | |
| 1,1,2-Trichloroethane | | | | | | | | |
| Trichloroethene | | | | | | | | |
| 1,2,3-Trichloropropane | | | | | | | | |
| Trichlorofluoromethane | | | | | | | | |
| Vinyl chloride | | | | | | | | |
| Benzene | | | | | | | | |
| Chlorobenzene | | | | | | | | |
| 1,2-Dichlorobenzene | | | | | | | | |
| 1,3-Dichlorobenzene | | | | | | | | |
| 1,4-Dichlorobenzene | | | | | | | | |
| Ethyl benzene | | | | | | | | |
| Toluene | | | | | | | | |
| m,p-Xylenes | | | | | | | | |
| o-Xylene | | | | | | | | |

* %DIFF = percentage difference with average Response Factor from the latest initial calibration

Site Name and Location:

Sampling Date:

Sample Collected by:

Sample Analysed by:

Page 1 of

| Smple ID | Dpth ft | Pur V ml | Vacum in Hg | Smple Time | Injct Time | Injct V ul | Compound 1 | | Compound 2 | | Compound 3 | | Compound 4 | | Compound 5 | | Compound 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l |
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Sampling and Analytical Notes:

Site Name and Location:

Sample Collected by:

Sampling Date:

Sample Analysed by:



| Smple ID | Dpth ft | Compound 7 | | Compound 8 | | Compound 9 | | Compound 10 | | Compound 11 | | Compound 12 | | Compound 13 | | Compound 14 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l | Area | ug/l |
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Sampling and Analytical Notes:

# SOIL GAS LABORATORY QUALITY CONTROL CHECK SAMPLES

DATE PERFORMED: _____ _____

INJECTION TIME: _____ _____

SUPPLY SOURCE: _____ _____

| COMPOUND | TRUE CONC | DET CONC | %DIFF | TRUE CONC | DET CONC | %DIFF |
|---|---|---|---|---|---|---|
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DATE PERFORMED: _____ _____

INJECTION TIME: _____ _____

SUPPLY SOURCE: _____ _____

| COMPOUND | TRUE CONC | DET CONC | %DIFF | TRUE CONC | DET CONC | %DIFF |
|---|---|---|---|---|---|---|
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# APPENDIX B

# PARAMETERS, METHODS, CONTAINER AND HOLDING TIME REQUIREMENTS

# REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES, SAMPLE VOLUMES, AND HOLDING TIMES FOR SOIL SAMPLES

| Name | Analytical Method | Container | Preservation | Customary Sample Volume or Weight | Maximum Holding Times |
|---|---|---|---|---|---|
| Volatile Organics | SW 8240 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 7 days |
| Semivolatile Organics | SW 8270 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 14 days for extraction and 40 days for analysis |
| *CAC Title 22 Metals* (plus strontium) | SW 6010, and SW 7000 Series | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days<br>28 days mercury |
| Ag, Ba, Be, Cd, Co, Cr, Cu, Mo, Ni, V, Zn, Sr, Cu, Mg, Na, K, Fe | SW 6010, and SW 7000 Series | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| Lead (Pb) | EPA 239.2 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| Antimony (Sb) | EPA 204.2 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| Selenium (Se) | EPA 270.1 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| Thallium (Tl) | EPA 279.2 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| Mercury (Hg) | EPA 245.1 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 28 days |
| Arsenic (As) | EPA 206.2 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 180 days |
| **Hexavalent Chromium** | **EPA 7196/7197** | **Stainless Steel Liners** | **Cool, 4°C** | **8 ounces** | **24 hours** |
| Cyanide | SW 9010 | Stainless Steel Liners | Cool, 4°C | 4 ounces | 14 days |
| Total Petroleum Hydrocarbons | EPA 418.1 | Stainless Steel Liners | Cool, 4°C | 8 ounces | 28 days |
| pH | SW 9045 | Stainless Steel Liners | Cool, 4°C | 8 ounces | ASAP |
| Soil Moisture | EPA 160.3 | Stainless Steel Liners | Cool, 4°C | 8 ounces | ASAP |

# REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES, SAMPLE VOLUMES, AND HOLDING TIMES FOR WATER SAMPLES

| Name | Analytical Method | Container | Preservation | Minimum Sample Volume or Weight | Holding Times |
|---|---|---|---|---|---|
| Volatile Organics | EPA 524.2 | Amber Glass | Cool, 4°C, HCl to pH < 2 | 3 X 40 ml | 7 days |
| *CAC Title 22 Metals* (plus strontium) (minus chromium) | | Polyethylene | Cool, 4°C, $HNO_3$ to pH < 2 | 500 ml | |
| Ag, Ba, Be, Cd, Co, Cu, Mo, Ni, V, Zn, Sr | SW 6010, and SW 7000 Series | Polyethylene | Cool, 4°C, $HNO_3$ to pH < 2 | | 180 days |
| Lead (Pb) | EPA 239.2 | Polyethylene | Cool, 4°C, $HNO_3$ to pH < 2 | | 180 days |
| Antimony (Sb) | EPA 204.2 | Polyethylene | $HNO_3$ to pH <2 | | 180 days |
| Selenium (Se) | EPA 270.1 | Polyethylene | $HNO_3$ to pH <2 | | 180 days |
| Thallium (Tl) | EPA 279.2 | Polyethylene | $HNO_3$ to pH <2 | | 180 days |
| Mercury (Hg) | EPA 245.1 | Polyethylene | $HNO_3$ to pH <2 | | 28 days |
| Arsenic (As) | EPA 206.2 | Polyethylene | $HNO_3$ to pH <2 | | 180 days |
| Hexavalent Chromium | EPA 218.5 | Polyethylene | Cool, 4°C | 125 ml | 24 hours |
| Cyanide | EPA 335 | Polyethylene | Cool, 4°C, NaOH to pH > 12 | 125 ml | 14 days |
| Major Anions (F, Cl, N, $SO_4$) | EPA 300 Series | Polyethylene | Cool, 4°C | 500 ml | 28 days (N=48 hrs) |
| Major Cations (Na, Mg, K, Ca, Fe) | EPA 200 Series | Polyethylene | Cool, 4°C, $HNO_3$ to pH < 2 | With Title 22 metals | 180 days |
| Total Dissolved Solids | EPA 160.1 | Polyethylene | Cool, 4°C | With major anions | field |
| Alkalinity | EPA 310.1 | Polyethylene | Cool, 4°C | With major anions | 14 days |
| Gross Alpha/Beta | 900.0 | Polyethylene | Cool, 4°C, $HNO_3$ to pH<2 | 1 liter | 6 months |
| Semi-Volatiles | SW 8270 | Amber Glass | Cool, 4°C | 2 x 1 liter | 14 days to extraction, 40 days for analysis |
| TPH | EPA 418.1 | Amber Glass | Cool, 4°C, HCl to pH<2 | 1 liter | 28 days |
| Total Phosphate | 365.4 | Polyethylene | Cool, 4°C, $H_2SO_4$ to pH<2 | 125 ml | 28 days |

# APPENDIX C

# AUDIT CHECKLIST

# FIELD AUDIT CHECKLIST

Signature of Auditor _____ Date of Audit _____

Project Coordinator _____ Project No. _____

Project Location _____

Type of Investigation _____
(Authority, Agency)

## Briefing with Project Coordinator

Yes__ No__ N/A__ 1. Was a project plan prepared? If yes, what items are addressed in the plan?_____

_____

_____

_____

Yes__ No__ N/A__ 2. Were additional instructions given to project participants (i.e., changes in project plan)? If yes, describe these changes._____

_____

_____

_____

Yes__ No__ N/A__ 3. Is there a written list of sampling locations and descriptions? If yes, describe where documents are.

_____

_____

_____

Yes__ No__ N/A__ 4. Is there a map of sampling locations? If yes, where is the map?_____

_____

_____

_____

## Briefing with Project Coordinator (continued)

Yes__ No__ N/A__ 5. Do the investigators follow a system of accountable documents? If yes, what documents are accountable?

_____

_____

_____

Yes__ No__ N/A__ 6. Is there a list of accountable field documents checked out to the project coordinator? If yes, who checked them out and where are the documents?_____

_____

_____

_____

Yes__ No__ N/A__ 7. Is the transfer of field documents (sample tags, chain-of-custody records, logbooks, etc.) from the project coordinator to the field participants documented? If yes, where is the transfer document?_____

_____

_____

_____

OTHER COMMENTS:

## FIELD AUDIT CHECKLIST

### Field Observations

Yes__ No__ N/A__ 1. Was permission granted to enter and inspect the facility? (Required in RCRA inspection)_____

Yes__ No__ N/A__ 2. Is permission to enter the facility documented? If yes, where is the document?_____

Yes__ No__ N/A__ 3. Were split samples offered to the facility? If yes, was the offer accepted or declined?_____

Yes__ No__ N/A__ 4. Is the offering of split samples recorded? If yes, where is it record?_____

Yes__ No__ N/A__ 5. Are the number, frequency and types of field measurements and observations taken as specified in the project plan or as directed by the project coordinator? If yes, where are they recorded?_____

**Field Observations (continued)**

Yes__ No__ N/A__ 6. Are samples collected in the type of containers specified for each type of analysis? If no, what kind of sample containers were used?_____

_____

_____

_____

Yes__ No__ N/A__ 7. Are samples preserved as required? If no or N/A, explain._____

_____

_____

_____

Yes__ No__ N/A__ 8. Are samples packed for preservation when required (i.e., packed in ice, etc.)? If no or N/A, explain why.

_____

_____

_____

Yes__ No__ N/A__ 9. Is simple custody maintained at all times? How?_____

_____

_____

_____

OTHER COMMENTS:

## FIELD AUDIT CHECKLIST

### Document Control

Yes__ No__ N/A__ 1. Have all unused and voided accountable documents been returned to the coordinator by the team members?_____

_____

_____

_____

Yes__ No__ N/A__ 2. Were any accountable documents lost or destroyed? If yes, have document numbers of all lost or destroyed accountable documents been recorded and where are they recorded?_____

_____

_____

_____

Yes__ No__ N/A__ 3. Are all samples identified with sample tags? If no, how are samples identified?_____

_____

_____

_____

Yes__ No__ N/A__ 4. Are all sample tags completed (e.g., station no., location, date, time, analyses, signatures of samplers, type, preservatives, etc,)? If yes, describe types of information recorded._____

_____

_____

_____

Yes__ No__ N/A__ 5. Are all samples collected listed on a chain-of-custody record? If yes, describe the type of chain-of-custody record used and what information is recorded._____

_____

_____

_____

**Document Control (continued)**

Yes__ No__ N/A__ 6. If used, are the sample tag numbers recorded on the chain-of-custody documents?_____

Yes__ No__ N/A__ 7. Does information on sample tags and chain-of-custody records match?_____

Yes__ No__ N/A__ 8. Does the chain-of-custody record indicate the method of sample shipment?_____

Yes__ No__ N/A__ 9. Is the chain-of-custody record included with the samples in the shipping container?_____

Yes__ No__ N/A__ 10. If used are blank samples identified?_____

Yes__ No__ N/A__ 11. If collected, are duplicate samples identified on sample tags and chain-of-custody records?_____

Yes__ No__ N/A__ 12. If used, are spiked samples identified?_____

**Document Control (continued)**

Yes__ No__ N/A__ 13. Are logbooks signed by the individual who checked out the logbook from the project coordinator?_____

Yes__ No__ N/A__ 14. Are logbooks dated upon receipt from the project coordinator?_____

Yes__ No__ N/A__ 15. Are logbooks project-specific (by logbook or by page)?

Yes__ No__ N/A__ 16. Are log book entries dated and identified by author?__

Yes__ No__ N/A__ 17. Is the facility's approval or disapproval to take photographs noted in a logbook?_____

Yes__ No__ N/A__ 18. Are photographs documented in logbooks (e.g., time, date, description of subject, photographer, etc.)?_____

Yes__ No__ N/A__ 19. If film from a self-developing camera is used, are photos matched with logbook documentation?_____

**Document Control (continued)**

Yes__ No__ N/A__ 20. If used are blank samples identified?_____

_____

_____

_____

Yes__ No__ N/A__ 21. If used are blank samples identified?_____

_____

_____

_____

OTHER COMMENTS:

## FIELD AUDIT CHECKLIST

### Debriefing with Project Coordinator

Yes__ No__ N/A__ 1. Was a debriefing held with project coordinator and/or other participants?

_____

_____

_____

Yes__ No__ N/A__ 2. Were any recommendations made to the project participants during the debriefing? If yes, list recommendations.

_____

_____

_____

_____

_____

_____

OTHER COMMENTS:

# LABORATORY AUDIT CHECKLIST

LABORATORY: _____

DATE: _____

TYPE OF EVALUATION: _____

CONTRACT NO.: _____

PERSONNEL CONTACTED: _____

| Name | Title |
|---|---|

EVALUATION TEAM:

| Name | Title |
|---|---|

| A. SAMPLE RECEIPT & STORAGE | YES | NO | COMMENTS |
|---|---|---|---|
| 1. Designated Custodian? | | | |
| 2. SOP written? | | | |
| 3. Sample receipt logbook maintenance? | | | |
| 4. QA/QC person review document periodically? | | | |
| 5. Samples stored in a 4C Refrigerator? | | | |
| 6. Walk-in temperature monitored? | | | |
| 7. Samples orderly kept? | | | |

| B. SAMPLE PREPARATION | YES | NO | COMMENTS |
|---|---|---|---|
| 1. Area well ventilated? | | | |
| 2. Hood working? | | | |
| 3. Extract kept in retrievable manner? | | | |
| 4. Standard supplied by certified agent? | | | |
| C. STANDARD PREPARATION | | | |
| 1. SOP Present? | | | |
| 2. Standard verified after prep.? | | | |
| 3. Standard stored in 4C temp.? | | | |

| D. ORGANIC INSTRUMENTATION | YES | NO | COMMENTS |
|---|---|---|---|
| 1. Tuning log kept? | | | |
| 2. SOP in place? | | | |
| 3. Service sticker present in Instr.? | | | |
| 4. Maintenance record kept? | | | |
| 5. Calibration records kept? | | | |
| 6. Run log kept? | | | |

| E. INORGANIC INSTURMENTATION | YES | NO | COMMENTS |
|---|---|---|---|
| 1. Service sticker present? | | | |
| 2. SOP in place? | | | |
| 3. Maintenance record kept? | | | |
| 4. Calibration records kept? | | | |
| F. TEMPERATURE CONTROL | | | |
| 1. Thermometer calibrated with NBS thermometer? | | | |
| 2. Oven calibrated? | | | |

| G. DATA HANDLING & REVIEW | YES | NO | COMMENTS |
|---|---|---|---|
| 1. Calculation spot checked? | | | |
| | | | |
| | | | |
| | | | |
| 2. Final review process in place? | | | |
| | | | |
| | | | |
| | | | |

DATA PACKAGE REVIEW: _____

OTHER COMMENTS: _____

# APPENDIX D

# SOIL-VAPOR STANDARD FORMS

# SOIL GAS DAILY CALIBRATION STANDARD REPORT

DATE: _____ _____

SUPPLY SOURCE: _____ _____

MACHINE ID: _____ _____

| COMPOUND | MASS | RT | RF | %DIFF* | MASS | RT | RF | %DIFF* |
|---|---|---|---|---|---|---|---|---|
| Carbon Tetrachloride | | | | | | | | |
| Chlorobenzene | | | | | | | | |
| Dibromochloromethane | | | | | | | | |
| 1,1-Dichloroethane | | | | | | | | |
| 1,2-Dichloroethane | | | | | | | | |
| 1,1-Dichloroethene | | | | | | | | |
| cis- and trans-1,2-Dichloroethene | | | | | | | | |
| Dichloromethane | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | | | | | | | | |
| Tetrachloroethene | | | | | | | | |
| 1,1,1-Trichloroethane | | | | | | | | |
| 1,1,2-Trichloroethane | | | | | | | | |
| Tetrachloroethane | | | | | | | | |
| Trichlorofluoromethane | | | | | | | | |
| Vinyl Chloride | | | | | | | | |
| Benzene | | | | | | | | |
| Ethylbenzene | | | | | | | | |
| Toluene | | | | | | | | |
| Xylenes | | | | | | | | |

* %DIFF = percentage difference with average Response Factor from the latest initial calibration

# SOIL GAS LABORATORY QUALITY CONTROL CHECK SAMPLES

DATE PERFORMED: _____ _____

INJECTION TIME: _____ _____

SUPPLY SOURCE: _____ _____

| COMPOUND | TRUE CONC | DET CONC | %DIFF | TRUE CONC | DET CONC | %DIFF |
|---|---|---|---|---|---|---|
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DATE PERFORMED: _____ _____

INJECTION TIME: _____ _____

SUPPLY SOURCE: _____ _____

| COMPOUND | TRUE CONC | DET CONC | %DIFF | TRUE CONC | DET CONC | %DIFF |
|---|---|---|---|---|---|---|
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EXAMPLE FORMAT

# SOIL GAS INITIAL CALIBRATION STANDARD REPORT

DATE: _____ ANALYST: _____ SID SOURCE: _____ MACHINE ID: _____

| COMPOUND | DETECTOR | 1st CONC _____ | | | | 2nd CONC _____ | | | | 3rd CONC _____ | | | | RF ave | SD | XRSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RT | MASS | AREA | RF | RT | MASS | RF | RT | RT | MASS | AREA | RF | | | |
| Carbon Tetrachloride | | | | | | | | | | | | | | | | |
| Chlorobenzene | | | | | | | | | | | | | | | | |
| Dibromochloromethane | | | | | | | | | | | | | | | | |
| 1,1-Dichloroethane | | | | | | | | | | | | | | | | |
| 1,2-Dichloroethane | | | | | | | | | | | | | | | | |
| 1,1-Dichloroethene | | | | | | | | | | | | | | | | |
| cis- and trans-1,2-Dichloroethene | | | | | | | | | | | | | | | | |
| Dichloromethane | | | | | | | | | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | | | | | | | | | | | | | | | | |
| Tetrachloroethene | | | | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | | | | | | | | | | | | | | | | |
| 1,1,2-Trichloroethane | | | | | | | | | | | | | | | | |
| Tetrachloroethane | | | | | | | | | | | | | | | | |
| Trichlorofluoromethane | | | | | | | | | | | | | | | | |
| Vinyl Chloride | | | | | | | | | | | | | | | | |
| Benzene | | | | | | | | | | | | | | | | |
| Ethylbenzene | | | | | | | | | | | | | | | | |
| Toluene | | | | | | | | | | | | | | | | |
| Xylenes | | | | | | | | | | | | | | | | |

EXAMPLE FORM

# ANALYSIS LOG SHEET

Site Name and Location: Sample Collected by:

Sampling Date: Sample Analyzed by: Page 1 of

| Sample ID | Depth ft | Pur V ul | Vacum in μg | Sample Time | Inject Time | Inject V ul | Compound 1 | | Compound 2 | | Compound 3 | | Compound 4 | | Compound 5 | | Compound 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Sampling and Analytical Notes:

# APPENDIX E

# DATA VALIDATION CHECKLIST

# ORGANIC DATA VALIDATION CHECKLIST

Laboratory _____

Package Identifier _____

Number of Samples _____

Matrix _____

Date received _____

The following checklist is divided into three parts. Part A is filled out if the data package contains VOA analyses, Part B for BNA analyses, and Part C for pesticides/PCBs. The review consisted of checking and verifying that the following performance criteria are within acceptable QC limits.

- Holding Time Review
- System Monitoring Compound (Surrogate) Review
- Matrix Spike/Matrix Spike Duplicate Review
- Blank Contamination Review
- GC/MS Instrument Performance Check
- Initial and Continuing Calibration Check
- Internal Standard Areas Check

Any exceedance in the QC limits are documented in the attached summary sheets.

The following qualifiers may be applied:

J = Positive result at an estimated value

R = Data is unreliable due to significant QC problems

B = Blank contamination

Data Reviewer _____ Date _____

Checked by _____ Date _____

## PART A: VOA ANALYSES

### I. Chain-of-Custody Records and Request for Analysis (C-O-C/RFA)

Are C-O-C/RFA Records present for all samples? [ ] Yes [ ] No

Do the C-O-C/RFA or Lab Narrative indicate any problems with sample receipt, condition of samples, analytical problems, or special circumstances affecting the quality of the data? [ ] Yes [ ] No

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**Action:** Use professional judgement to evaluate the effect on the quality of the data.

### II. Holding Times

Have any VOA technical holding times, determined from date of collection to date of analysis, been exceeded? [ ] Yes [ ] No

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Note: Preserved aqueous and soil samples must be analyzed within 14 days and unpreserved aqueous samples must be analyzed within 7 days.

**Action:** If exceeded by 1 to 30 days, flag all detects as estimated (J). If severely exceeded by more than 30 days, the reviewer will use professional and other technical information to qualify or reject data.

## III. System Monitoring Compound (Surrogates) Analysis

Was any VOA surrogate recovery outside of specifications for any sample or method blank? [ ] Yes [ ] No

---

---

**Action:** If recoveries are >10% but one or more compounds fail to meet specifications, positive results are qualified as estimated (J). If any surrogate compound recovery is <10%, flag all positive results as estimated (J).

Note: Professional judgement should be used to qualify data that have method blank surrogate recoveries out of specification in both original and re-analyses. Check the internal standard areas.

## IV. Matrix Spikes

Is the Matrix Spike/Matrix Spike Duplicate Recovery Form present? [ ] Yes [ ] No

Were matrix spikes analyzed at the required frequency for each of the following matrices:

a. Water [ ] Yes [ ] No

b. Soil [ ] Yes [ ] No

---

---

**Action:** If any matrix spike data are missing, please contact lab.

**Action:** No action is taken based on MS/MSD data alone. However, professional judgement may be used in conjunction with other QC criteria to determine the need for qualification of the data.

## V. Blanks

Is the Method Blank Summary present? [ ] Yes [ ] No

Has a VOA method/instrument blank been analyzed for each extraction batch. [ ] Yes [ ] No

**Action:** If any method blank data are missing, please contact lab.

Chromatography: Review the blank raw data - chromatograms (RICs), quant reports, or data system printouts and spectra. Is the chromatographic performance (baseline stability) for each instrument acceptable for VOAs? [ ] Yes [ ] No

---

---

**Action:** Use professional judgement to determine the effect on the data.

**Action:** For common lab contaminants: Sample concentrations > CRQL but < 10x blank value should be qualified with B. Use the largest value from all the associated blanks.

Note: Trip blanks are used to qualify only those samples with which they were shipped and are only required for VOA matrices. Blanks may not be qualified because of contamination in another blank. Field Blanks and Trip Blanks must be qualified for system monitoring compound, instrument performance criteria, spectral or calibration QC problems.

## VI. GC/MS Instrument Performance Check

Are the GC/MS Instrument Performance Check Forms present for bromofluorobenzene (BFB)? [ ] Yes [ ] No

Has an instrument performance compound been analyzed successfully? [ ] Yes [ ] No

---

---

Have the ion abundances been normalized to m/z 95? [ ] Yes [ ] No

**Action:** Qualify data as unreliable, "R",if criteria are not met.

Is the RRT of each reported compound within 0.06 RRT units of the standard RRT in the continuing calibration? [ ] Yes [ ] No

Are all ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the sample mass spectrum? [ ] Yes [ ] No

Do sample and standard relative ion intensities agree within 20%? [ ] Yes [ ] No

---

---

**Action:** Use professional judgement to determine acceptability of data. If it is determined that incorrect identifications were made, all such data should be qualified unreliable, (R), or changed to not detected (U) at the calculated detection limit.

**Action:** When sample carryover is a possibility, professional judgement should be used to determine if instrument cross-contamination has affected any positive compound identification.

## VIII. GC/MS Initial Calibration

Are the Initial Calibration Forms present and complete for the volatile fraction? [ ] Yes [ ] No

**Action:** If any calibration standard forms are missing, please contact lab.

Are the RRFs above 0.05 for TCL/HSL compounds, 0.01 for all other compounds? [ ] Yes [ ] No

---

---

Are response factors stable for VOAs over the concentration range of the calibration (%RSD <30%)? [ ] Yes [ ] No

**Action:** If %RSD >30% but <75%, qualify associated positive results for that analyte as "J". If %RSD >75%, qualify associated positive results as "J".

## IX. Internal Standard

Are the internal standard areas of every sample and blank within the upper and lower limits for each continuing calibration? [ ] Yes [ ] No

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**Action:** If the internal standard area count is outside the upper or lower limit, flag "J" all positive results. If extremely low area counts (<25%) are reported, or if performance exhibits a major abrupt drop-off, the reviewer may choose to qualify or reject the entire sample.

Note: If the IS area is above 150%, use professional judgement.

Are the retention times of the internal standards within 30 seconds of the associated calibration standard? [ ] Yes [ ] No

**Action:** Professional judgement should be used to qualify data if the retention times differ by more than 30 seconds to determine if a false positive or negative exists.

## PART B: BNA ANALYSES

### I. Chain-of-Custody Records and Request for Analysis (C-O-C/RFA)

Are C-O-C/RFA Records present for all samples? [ ] Yes [ ] No

**Action:** If no, note on the request from the laboratory.

Do the C-O-C/RFA or Lab Narrative indicate any problems with sample receipt, condition of samples, analytical problems, or special circumstances affecting the quality of the data? [ ] Yes [ ] No

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**Action:** Use professional judgement to evaluate the effect on the quality of the data.

### II. Holding Times

Have any BNA technical holding times, determined from date of collection to date of analysis, been exceeded? [ ] Yes [ ] No

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Note: Soil and water samples for BNA analysis must be extracted within 14 days of the date of collection. Extracts must be analyzed within 40 days of the date of extraction.

**Action:** If technical holding times are exceeded, qualify the data with "J" as estimated.

## III. System Monitoring Compound (Surrogates) Analysis

Are the BNA System Monitoring Compound (surrogates) Summary Forms present for each of the following matrices:

a. Water [ ] Yes [ ] No

b. Soil [ ] Yes [ ] No

Were two or more base-neutral OR acid SMCs out of specifications for any sample or method blank? [ ] Yes [ ] No

If yes, were samples reanalyzed? [ ] Yes [ ] No

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**Action:** If all BNA system monitoring compounds (SMC) recoveries are >10% but two within the base-neutral or acid fraction do not meet specifications, for the affected fraction only (i.e., base-neutral or acid compounds), flag all results as estimated (J). If any one base-neutral or acid system monitoring compound has a recovery of <10%, positive results for the fraction with surrogates <10% recovery are qualified as estimates (J).

Note: Professional judgement should be used to qualify data that have method blank system monitoring compound recoveries out of specification in both original and re-analyses. Check the internal standard areas.

## IV. Matrix Spikes

Is the MS/MSD Recovery Form present? [ ] Yes [ ] No

Were matrix spikes analyzed at the required frequency for each of the following matrices:

a. Water [ ] Yes [ ] No

b. Soil [ ] Yes [ ] No

**Action:** No action is taken on MS/MSD data alone. However, using informed professional judgement, the data reviewer may use the matrix spike and matrix spike duplicate results in conjunction with other QC criteria and determine the need for qualification of the data.

## V. Blanks

Is the Method Blank Summary present? [ ] Yes [ ] No

Has a reagent/method blank analysis been reported for each extraction batch? [ ] Yes [ ] No

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Chromatography: Review the blank raw data - chromatograms (RICs), quant reports, or data system printouts and spectra. Is the chromatographic performance (baseline stability) for each instrument acceptable for BNAs? [ ] Yes [ ] No

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**Action:** Use professional judgement to determine the effect on the data.

## VI. Contamination

Do any method/instrument/reagent blanks have positive results for BNAs? [ ] Yes [ ] No

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**Action:** For common lab contaminants, if the concentration in the sample is less than ten times the concentration in the most contaminated associated blank, flag the sample data "J" (estimated).

## VII. GC/MS Instrument Performance Check

Are the GC/MS Instrument Performance Check Forms present for decafluorotriphenylphosphine (DFTPP)? [ ] Yes [ ] No

Are the enhanced bar graph spectrum and mass/charge (m/z) listing for the DFTPP provided? [ ] Yes [ ] No

Has an instrument performance compound been analyzed successfully? [ ] Yes [ ] No

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**Action:** If mass assignment is in error, Qualify data as unreliable, "R", if criteria are not met.

Have the ion abundances been normalized to m/z 198? [ ] Yes [ ] No

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**Action:** If ion abundance criteria are not met, use professional judgement to determine what action, if any, is required.

Is the RRT of each reported compound within 0.06 RRT units of the standard RRT in the continuing calibration? [ ] Yes [ ] No

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Are all ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the sample mass spectrum? [ ] Yes [ ] No

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**Action:** Use professional judgement to determine acceptability of data. If it is determined that incorrect identifications were made, all such data should be rejected (R). The data must comply with the above criteria.

## VIII. GC/MS Initial Calibration

Are the Initial Calibration Forms present and complete for the BNA fraction? [ ] Yes [ ] No

Are response factors stable for BNAs over the concentration range of the calibration? (% Relative standard deviation [%RSD] <30.0%) [ ] Yes [ ] No

**Action:** If %RSD >30% but <75%, qualify associated positive results for that analyte as "J". If %RSD >75%, qualify associated positive results as "J".

Are all BNA compounds RRFs >0.05 for TCL/HSL compounds, 0.01 all other compounds? [ ] Yes [ ] No

**Action:** If any RRF <0.05 TCL/HSL and 0.01 for all other compounds qualify the unreliable, "R".

## IX. GC/MS Continuing Calibration

Are the Continuing Calibration Forms present and complete for the BNA fraction? [ ] Yes [ ] No

Has a continuing calibration standard been analyzed successfully at the required frequency? [ ] Yes [ ] No

**Action:** If any forms are missing or no continuing calibration standard has been analyzed within the required time of every sample analysis, flag all associated sample data as unreliable (R).

Do any semivolatile compounds have a % Difference (%D) between the initial and continuing RRF which exceeds the 25.0% criteria? [ ] Yes [ ] No

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**Action:** If the %D >25% but <75%, qualify positive results as estimated (J). If the %D >75%, qualify positive results as estimated (J).

Do any semivolatile compounds have a RRF <0.05 TCL/HSL, 0.01 all other compounds? [ ] Yes [ ] No

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**Action:** If RRF <0.05 TCL/HSL, 0.01 all other compounds, qualify "J" associated positive values.

## X. Internal Standard

Are the internal standard areas of every sample and blank within the upper and lower limits for each continuing calibration? [ ] Yes [ ] No

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**Action:** If the internal standard area count is outside the upper or lower limit, flag "J" all positive results. If extremely low area counts (<25%) are reported, or if performance exhibits a major abrupt drop-off, the reviewer may choose to qualify or reject the entire sample.

Note: If the IS area is above 150%, use professional judgement to qualify the non-detects.

Are the retention times of the internal standards within

30 seconds of the associated calibration standard? [ ] Yes [ ] No

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**Action:** Professional judgement should be used to qualify data if the retention times differ by more than 30 seconds to determine if a false positive or negative exists.

## PART C: PESTICIDE/PCB ANALYSES

### I. Chain-of-Custody Records and Request for Analysis (C-O-C/RFA)

Are C-O-C/RFA Records present for all samples? [ ] Yes [ ] No

**Action:** If no, please contact laboratory.

Do the C-O-C/RFA or Lab Narrative indicate any problems with sample receipt, condition of samples, analytical problems, or special circumstances affecting the quality of the data? [ ] Yes [ ] No

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**Action:** Use professional judgement to evaluate the effect on the quality of the data.

### II. Holding Times

Have any Pest/PCB technical holding times, determined from date of collection to date of analysis, been exceeded? [ ] Yes [ ] No

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Note: Water and soil samples for Pest/PCB analysis must be extracted within 14 days of the date of collection. Extracts must be analyzed within 40 days of the date of extraction.

**Action:** If technical holding times are exceeded and depending on the number of days, qualify the data with "J" as estimated or "R", unreliable.
Use professional judgement and provide justification / explanation for conclusion.

## III. System Monitoring Compound (TCX and DBC) Recovery

Are the Pest/PCB System Monitoring Compound (TCX and DCB) Summary Forms present. [ ] Yes [ ] No

Were System Monitoring Compound recoveries of TCX or DCB outside of the contract specification for any sample or blank? [ ] Yes [ ] No

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**Action:** No qualification is done if system monitoring compounds (SMC) are diluted out. If recovery for both SMCs are below the contract limit, but above 10%, flag positive results for that sample as "J". If recovery is <10% for either SMC, qualify positive results as "J". If recovery is above the contract advisory limits for both SMCs, qualify positive values as "J".

Were System Monitoring Compound retention times (RT) within the windows established during the initial 3-point analysis of Individual Standard Mixture A? [ ] Yes [ ] No

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**Action:** If the RT limits are not met, the analysis may be qualified unreliable "R" for that sample on the basis of professional judgement.

## IV. Matrix Spikes

Is the MS/MSD Recovery Form present? [ ] Yes [ ] No

Were matrix spikes analyzed at the required frequency for each of the following matrices:

[ ] Yes [ ] No

**Action:** No action is taken on MS/MSD data alone. However, using informed professional judgement, the data reviewer may use the matrix spike and matrix spike duplicate results in conjunction with other QC criteria and determine the need for qualification of the data.

## V. Blanks

Has a reagent/method blank been analyzed for each extraction batch. [ ] Yes [ ] No

Has a Pest/PCB instrument blank been analyzed following the initial calibration sequence? [ ] Yes [ ] No

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## VI. Contamination

Do any method/instrument/reagent blanks have positive results for Pest/PCBs? [ ] Yes [ ] No

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**Action:** Sample concentrations > CRQL but less than 5X the largest value for all the associated blanks, should be qualified with "B".

Note: If gross blank contamination exists (i.e., saturated peaks), all affected compounds in the associated samples should be qualified as unreliable (R) due to interference.

## VII. Calibration and GC Performance

Are all Calibration and GC Performance Forms present and complete for each column and each analytical sequence? [ ] Yes [ ] No

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Do all standard retention times fall within the windows established during the initial calibration analytical sequence? (For Initial Calibration Standards.) [ ] Yes [ ] No

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**Action:** If no, all samples in the entire analytical sequence are potentially affected. Check to see if the chromatograms contain peaks within an expanded window surrounding the expected retention times. If no peaks are found and the surrogates are visible, non-detects are valid. If peaks are present and cannot be identified through pattern recognition or using a revised RT window, qualify all positive results as unreliable, "R". For Aroclors, RT may be outside the RT window, but the Aroclor may still be identified from the individual pattern.

Are the linearity criteria for the initial analyses of within limits for both columns? (%RSD must be <20.0% for all analytes except for the two surrogates which must not exceed 30.0 %RSD). [ ] Yes [ ] No

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**Action:** If no, qualify all associated positive results generated during the entire analytical sequence as estimated (J).

Are the Pesticide Evaluation Standards Summary Forms present and complete for each Performance Evaluation Mixture analyzed during the analytical sequence for both columns? [ ] Yes [ ] No

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Has the individual % breakdown exceeded 20.0% on either column?

- for 4,4'-DDT? [ ] Yes [ ] No
- for endrin? [ ] Yes [ ] No

Has the combined % breakdown for 4,4'-DDT/Endrin exceeded 30.0% on either column? [ ] Yes [ ] No

**Action:** If any % breakdown has failed the QC criteria in the initial calibration sequence, qualify all sample analyses in the entire analytical sequence as described below.

**Action:** If any % breakdown has failed the QC criteria in a PEM Verification calibration, review data beginning with the samples which followed the last in-control standard until the next acceptable PEM and qualify the data as described below.

**a.** **4,4'-DDT Breakdown: If 4,4'-DDT breakdown is greater than 20.0%:**

i. Qualify all positive results for DDT with "J". If DDT was not detected, but DDD and DDE are positive, then qualify the quantitation limit for DDT as unreliable (R).

ii. Qualify positive results for DDD and/or DDE as estimated (J).

**b.** **Endrin Breakdown: If endrin breakdown is greater than 20.0%:**

i. Qualify all positive results for endrin with "J". If endrin was not detected, but endrin aldehyde and endrin ketone are positive, then qualify the quantitation limit for endrin as unusable (R).

ii. Qualify positive results for endrin ketone and endrin aldehyde as presumptively present at an approximated quantity (J).

Are the relative percent difference (RPD) values for all PEM analytes <25.0%? [ ] Yes [ ] No

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**Action:** If no, qualify all associated positive results generated during the analytical sequence as "J" and sample quantitation limits as "J".

Note: If the failing PEM is part of the initial calibration, all samples are potentially affected. If the offending standard is a verification calibration, the associated samples are those which followed the last in-control standard until the next passing standard.

Have all samples been injected within a 12-hour period beginning with the injection of an Instrument Blank? [ ] Yes [ ] No

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**Action:** If no, use professional judgement to determine the severity of the effect on the data and qualify accordingly.

Is the Pesticide Calibration Verification Summary form present and complete for each INDA and INDB Verification Calibration analyzed? [ ] Yes [ ] No

Do all standard retention times for each INDA and INDB Verification Calibration fall within the windows established by the initial calibration sequence? [ ] Yes [ ] No

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**Action:** If no, beginning with the samples which followed the last in-control standard, check to see if the chromatograms contain peaks within an expanded window surrounding the expected retention times. If no peaks are found and the surrogates are visible, non-detects are valid. If peaks are present and cannot be identified through pattern recognition or using a revised RT window, qualify all positive results as unreliable "R".

Are RPD values for all verification calibration standard compounds <25.0%? [ ] Yes [ ] No

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**Action:** If the RPD is >25.0% for the compound being quantitated, qualify all associated positive results as "J". The "associated samples" are those which followed the last in-control standard up to the next passing standard containing the analyte which failed the criteria.

## VIII. Pesticide/PCB Identification

Is the Pesticide/PCB Identification Form complete for every sample in which a pesticide or PCB was detected? [ ] Yes [ ] No

Are retention times (RT) of sample compounds within the established RT windows for both analyses? [ ] Yes [ ] No

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**Action:** Qualify as unreliable "R" all positive results which were not confirmed during the second GC column analysis. Also qualify as unreliable "R" all positive results not

meeting RT window unless associated standard compounds are similarly biased The reviewer should use professional judgement to assign an appropriate quantitation limit.

Is the percent difference (%D) calculated for the positive sample results on the two GC columns <25.0%? [ ] Yes [ ] No

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**Action:** If no, qualify all associated positive data estimated (J).

## IX. Compound Quantitation and Reported Detection Limits

Note: Single-peak pesticide results can be checked for rough agreement between quantitative results obtained on the two GC columns. The reviewer should use professional judgement to decide whether a much larger concentration obtained on one column versus the other indicates the presence of an interfering compound. If an interfering compound is indicated, the lower of the two values should be reported and qualified as presumptively present at an approximated quantity (J). This necessitates a determination of an estimated concentration on the confirmation column. The

## COMMENTS

The case description and exceptions, if any, are noted below, with reason(s) for rejection (R) or qualification as estimated (J). Any laboratory deficiencies are also noted in this section.

# INORGANIC DATA VALIDATION CHECKLIST

Laboratory _____

Package Identifier _____

Number of Samples _____

Matrix _____

Date received _____

This data package has been reviewed and the Quality Assurance and performance data summarized. The review is based on the following information; Holding times, calibration, blanks, spikes, duplicates, and sample result verification.

Any exceedance in the QC limits are documented in the attached summary sheets. The following qualifiers may be applied:

J = Positive result at an estimated value

R = Data is unreliable due to significant QC problems

B = Blank contamination

Data Reviewer _____ Date _____

Checked by _____ Date _____

## I. Holding Times/Preservation Requirements

Examine the Chain of Custody, the digestion and distillation logs.

Metals 6 months, preserved to pH <2 with $HNO_3$
Mercury 28 days preserve to ph <2 with $HNO_3$
Cyanide 14 days, preserve to pH <12 with NaOH

Were all holding times and preservation requirements met? [ ] Yes [ ] No

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**Action:** If exceeded by 1 to 30 days, flag all detects as estimated (J). If severely exceeded by more than 30 days, the reviewer will use professional and other technical information to qualify or reject data.

## II. Calibration

Was the instrument calibrated daily or at each time it was set up? [ ] Yes [ ] No

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ICP Analyses - Was a blank and one standard used in establishing the analytical curve? [ ] Yes [ ] No

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Atomic Absorption Analysis - Was a blank and 3 standards, one of which must be at the method detection limit used in establishing the analytical curve with a correlation coefficient of >0.995? [ ] Yes [ ] No

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Mercury Analyses - Was a blank and four standards used in establishing the analytical curve with a correlation coefficient of >0.995? [ ] Yes [ ] No

Cyanide Analyses - Was a blank and three standards used in establishing the analytical curve with a correlation coefficient of >0.995? [ ] Yes [ ] No

**Action:** If the minimum number of standards have not been used, or if the instrument was not calibrated daily or each time it was set up, reject all associated data (R).

**Action:** If the midrange standard for cyanide was not distilled qualify all positive values estimated (J).

**Action:** If one of the standards for AA was not ran at the IDL note in the comments section and use professional judgement in qualifying the samples.

**Action:** If the correlation coefficient less than 0.995 flag all detects with a (J) as estimated.

## III. Initial and Continuing Calibration Verification

Were initial and continuing calibrations present and complete for every metal and cyanide? [ ] Yes [ ] No

**Action:** If no, please request this information from the laboratory

Are all calibration standards (initial and continuing) within control limits? [ ] Yes [ ] No

Metals 90-110% [ ] Yes [ ] No

Mercury 80-120% [ ] Yes [ ] No

Cyanide 85-115% [ ] Yes [ ] No

For verification purpose, recalculation of one or more of the ICV and CCV% %R per type of analysis (ICP, GFAA) using the following equation:

$$\%R = \frac{\text{FOUND}}{\text{TRUE}} \times 100$$

Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution.

True = concentration (in ug/L) of each analyte in the ICV or CCV source.

**Action:** If continuing calibration recovery falls outside the acceptance windows, professional judgement will be used to evaluate impact on data quality.

**IV. Blanks**

Was an initial and continuing blank analyzed? [ ] Yes [ ] No

Was a prep. blank analyzed for each batch and each matrix type? [ ] Yes [ ] No

Were contaminants detected in the blank? [ ] Yes [ ] No

**Action:** If samples associated with the blank have an analyte concentration greater than the IDL but less than five times the blank concentration, qualify the data a (B).

The actual comparison of blank and sample results will be based on actual instrument value, particularly for soil matrix. This approach will eliminate variability in results due to sample weight/volume, percent moisture, etc. which vary from sample to sample. In instances where more than one blank is associated with a given sample, qualification should be based upon associated blank having the highest concentration of a contaminant.

## V. ICP Interference Check Sample

The ICP interference check samples verifies laboratory interelement and background corrective factors. Results of the ICS solution must fall within the control limits of ±20% of the true value.

(Note: Not required for furnace AA, flame AA, mercury, cyanide and Ca, Mg, K and Na).

Was ICS analyzed at the beginning and end of run or at least twice every 8 hours? [ ] Yes [ ] No

**Action:** If no, flag as estimated (J) all samples for which Al, Ca, Fe, or Mg is higher than in ICS.

Indicate all values that are more than +/- 20% of true or established mean value. Are all interference check sample results inside of control limits (±20%)? [ ] Yes [ ] No

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If no, is concentration of Al, Ca, Fe, or Mg lower than the respective concentration in ICS? [ ] Yes [ ] No

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**Action:** If no, flag as estimated (J) those positive results for which ICS recovery is greater than 121%; flag all sample results as estimated (J) if ICS recovery falls within 50-79%; Flag all sample results as unreliable (R) for which the ICS recovery is less than 50%.

If results greater than the IDL are observed for elements which are not present in the EPA provided ICS solution, the possibility of false positives exists. An evaluation of the associated sample data for the affected elements should be made. For samples with comparable or higher levels of interferents and with analyte concentrations that approximate those levels found in the ICS (false positives), qualify sample results >IDL as estimate (J).

## VI. Laboratory Control Sample

Do all aqueous LCS results fall within the control limits of 80-120% with the exception of Antimony and Silver which have no control limits? Do all solid LCS results fall within control limits as established by EPA? [ ] Yes [ ] No

**Action:** If the LCS recovery for any analyte falls within the range of 50-79% or >120%, qualify results >IDL as estimated (J).

If the LCS recovery results are <50%, qualify the data for these samples as unreliable (R).

## VII. Duplicate Sample Analysis

Present for each 20 samples? [ ] Yes [ ] No

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Present for each Matrix type? [ ] Yes [ ] No

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**Action:** If no for any of the above, flag as estimated (J) all data >RDL for which duplicate sample was not analyzed.

Note: 1. If one duplicate sample was analyzed for more than 20 samples, then the first 20 samples do not have to be flagged as estimated.

2. If percent solids for soil sample and its duplicate differ by more than 1%, calculate RPD based on wet weight.

Are all values within control limits RPD 20% (35% for soil) for sample values >5X CRDL? [ ] Yes [ ] No

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**Action:** If a duplicate analysis results for an analyte fall outside the control windows, qualify the results for that analyte in all associated samples of the same matrix (J).

## VII. Matrix Spike Analysis

Are all values within control limits 75-125%? [ ] Yes [ ] No

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Note: Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.

**Action:** If the spike recovery is >125% and the reported sample results are <IDL, the data is acceptable.

If the spike recovery is >125% or <75% and the sample results are >IDL qualify the data for these samples are as estimated.

## VII. Furnace Atomic Absorption (AA) QC

Are duplicate injections present in furnace raw data for each sample analyzed by GFAA? [ ] Yes [ ] No

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**Action:** If no, use professional judgement to qualify data.
Are the Spike recoveries within control limits ≥85% and ≤115%? [ ] Yes [ ] No

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Do the duplicate injection readings agree within 20% Relative Standard Deviation (RSD) or Coefficient of Variation (CV)? [ ] Yes [ ] No

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If the (RSD) or (CV) was above 20%, was the sample reanalyzed? [ ] Yes [ ] No

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**Action:** If the sample was not reanalyzed, or if upon reanalyses the criteria are not met, qualify the associated data estimated (J).

If the post digestion spike recovery is <40%, qualify result >IDL as estimated (J).

If post digestion spike recovery is <10%, qualify results <IDL unusable (R).

## IX. Serial Dilution

If the analyte concentration is sufficiently high (concentration in the original sample is minimally a factor of 50 above the IDL), an analysis of a 5-fold dilution must agree within 10% Difference (%D) or the original results.

Action: When criteria are not met, qualify the associated data as estimated (J).

## X. Sample Result Verification

Analyte quatitation must be calculated according to the SOW.

**Action:** If any discrepancies are found, the laboratory must be contacted to obtain additional, information that could resolve any differences.

Was one LCS prepared and analyzed at the beginning for:

Water Samples? [ ] Yes [ ] No

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Solid Samples? [ ] Yes [ ] No

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**Action:** If no for any of the above, note in the comments section and flag all data with a (J) for which no LCS was analyzed.

## XI. Comments Section

Please express concerns and comments on the validity of the overall data. Exceptions, if any, should be noted below with reason(s) for rejecton (R) or qualification as estimated (J). Any laboratory deficiencies also should be noted in this section.

# APPENDIX F

# PROJECT SCHEDULE

# JPL - FINAL RI/FS SCHEDULE

| Activity ID | Activity Description | Start | Finish |
|---|---|---|---|
| | **PROJECT WIDE DOCUMENTS** | | |
| 00100A | RI/FS Workplan to EPA | 1Mar93 | 7Jun93 |
| 00100B | QAPP to EPA | 1Mar93 | 7Jun93 |
| 00100C | Community Relations to EPA | 1Mar93 | 7Jun93 |
| 00100D | EPA Review Draft RI/FS Workplan | 7Jun93 | 6Aug93 |
| 00100E | EPA Review Draft GAPP | 7Jun93 | 6Aug93 |
| 00100F | EPA Review Draft Community Relations Plan | 7Jun93 | 6Aug93 |
| 00100G | RI/FS Workplan Finalized | 6Aug93 | 24Sep93 |
| 00100H | QAPP Finalized | 6Aug93 | 24Sep93 |
| 00100I | Community Relations Plan Finalized | 6Aug93 | 24Sep93 |
| | **OU-1 ON-SITE GROUNDWATER** | | |
| 00101A | OU-1 FSAP to EPA | 1Mar93 | 7Jun93 |
| 00101B | EPA Review OU-1 FSAP | 7Jun93 | 6Aug93 |
| 00101C | Groundwater Modeling | 7Jun93 | 20Apr94 |
| 00101D | OU-1 FSAP Finalized | 6Aug93 | 24Sep93 |
| 00101E | RI Fieldwork | 24Sep93 | 20Jun94 |
| 00101F | Lab Data Validation | 22Jun94 | 26Jun94 |
| 00101G | Prepare RI Report | 22Jun94 | 29Sep94 |
| 00101H | Prepare FS Report/Proposed Plan | 27Jul94 | 5Dec94 |
| 00101I | EPA Review RI Report | 29Sep94 | 28Nov94 |
| 00101J | RI Report Finalized | 28Nov94 | 23Jan95 |
| 00101K | EPA Review FS Report/Proposed Plan | 5Dec94 | 3Feb95 |
| 00101L | FS Report/Proposed Plan Finalized | 3Feb95 | 31Mar95 |
| 00101M | Public Comment on Proposed Plan | 31Mar95 | 1May95 |
| 00101N | Rod Prepared | 27Apr95 | 15Jun95 |
| 00101O | EPA Review Rod | 15Jun95 | 14Aug95 |
| 00101P | Rod Finalized | 14 Aug 95 | 13 Oct95 |
| | **OU-2 ON-SITE GROUNDWATER** | | |
| 00102A | OU-2 FSAP to EPA | 29Mar93 | 7Jul93 |
| 00102B | EPA Review OU-2 FSAP | 7Jul93 | 6Sep93 |
| 00102C | OU-2 FSAP Finalized | 6Sep93 | 26Oct93 |
| 00102D | RI Fieldwork | 27Oct93 | 23Sep94 |
| 00102F | Prepare RI Report | 26Aug94 | 30Nov94 |
| 00102E | Lab Data Validation | 24Sep94 | 31Oct94 |

# JPL - FINAL RI/FS SCHEDULE

(Continued)

| Activity ID | Activity Description | Start | Finish |
|---|---|---|---|
| 00102I | Prepare FS Report/Proposed Plan | 30Oct94 | 10Feb95 |
| 00102G | EPA Review RI Report | 30Nov94 | 30Jan95 |
| 00102H | RI Report Finalized | 30Jan95 | 27Mar95 |
| 00102J | EPA Review FS Report/Proposed Plan | 10Feb95 | 11Apr95 |
| 00102K | FS Report/Proposed Plan Finalized | 11Apr95 | 6Jun95 |
| 00102L | Public Comment on Proposed Plan | 6Jun95 | 6Jul95 |
| 00102M | Rod Prepared | 19Jun95 | 8Aug95 |
| 00102N | EPA Review Rod | 8Aug95 | 9Oct95 |
| 00102O | Rod Finalized | 9Oct95 | 8Dec95 |
| | **OU-3 OFF-SITE GROUNDWATER** | | |
| 00103A | OU-3 FSAP to EPA | 2Aug93 | 29Oct93 |
| 00103B | EPA Review OU-3 FSAP | 29Oct93 | 28Dec93 |
| 00103C | OU-3 FSAP Finalized | 28Dec93 | 28Feb94 |
| 00103D | RI Fieldwork | 2Mar94 | 13Feb95 |
| 00103E | Groundwater Modeling | 6Jul94 | 12Jan95 |
| 00103J | Prepare FS Report/Proposed Plan | 24Jan95 | 31May95 |
| 00103F | Lab Data Validation | 14Feb95 | 20Mar95 |
| 00103G | Prepare RI Report | 22Feb95 | 22May95 |
| 00103H | EPA Review RI Report | 22May95 | 21Jul95 |
| 00103K | EPA Review FS Report/Proposed Plan | 31May95 | 31Jul95 |
| 00103K | RI Report Finalized | 21Jul95 | 19Sep95 |
| 00103L | FS Report/Proposed Plan Finalized | 31Jul95 | 29Sep95 |
| 00103M | Public Comment on Proposed Plan | 29Sep95 | 30Oct95 |
| 00103N | Prepare Rod | 30Oct95 | 19Dec95 |
| 00103O | EPA Review Rod | 19Dec95 | 18Jan95 |
| 00103P | Rod Finalized | 18Jan96 | 18Mar96 |